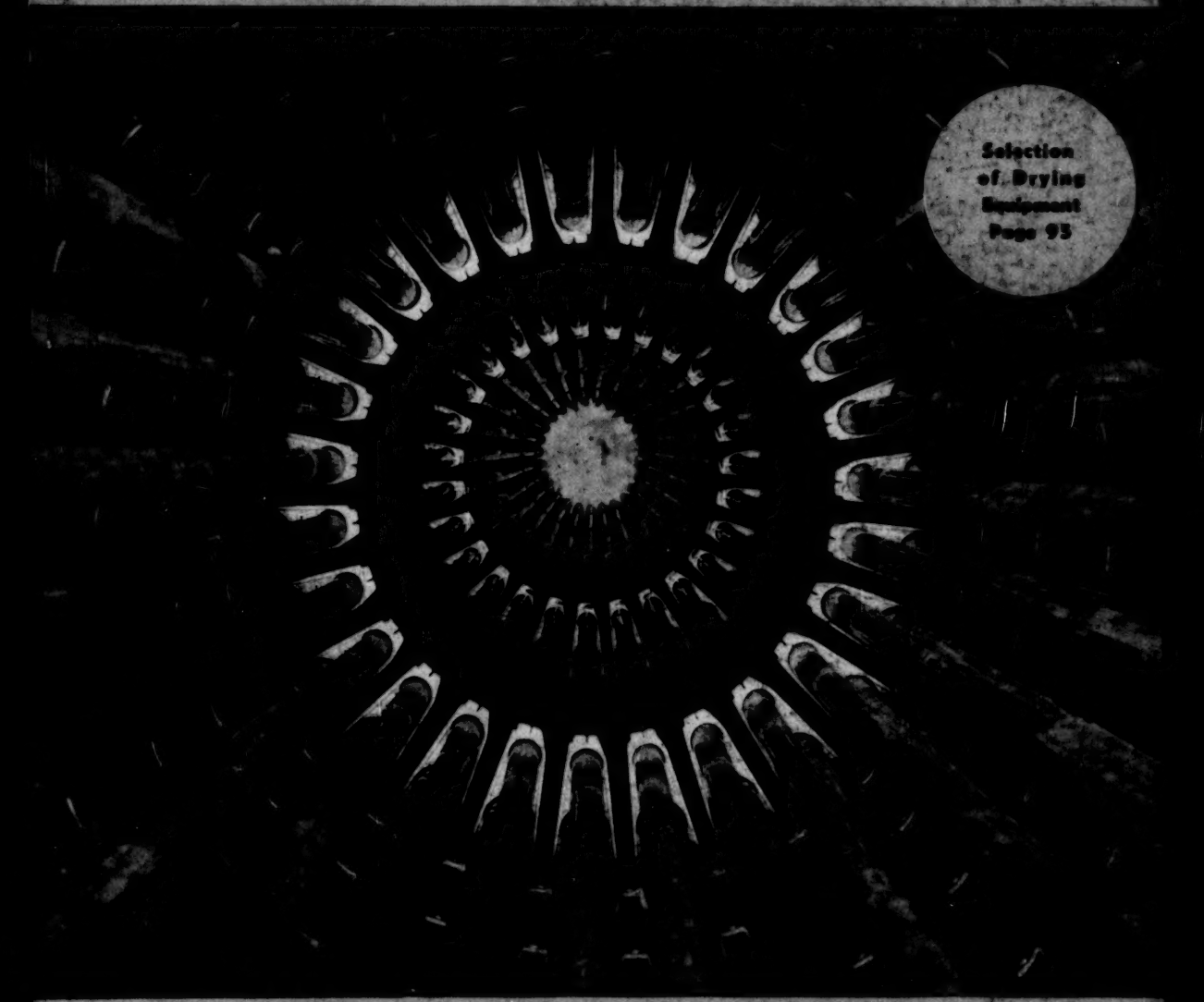
FEBRUARY, 1951

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION



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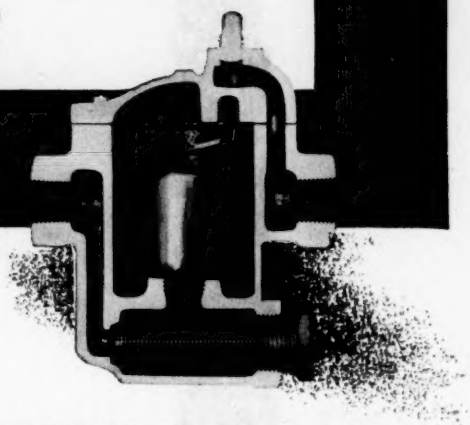
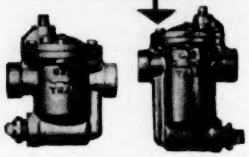
Money Saving Steam Traps with the Strainers *Built Right In*

. . . Now Available in *Two Sizes*

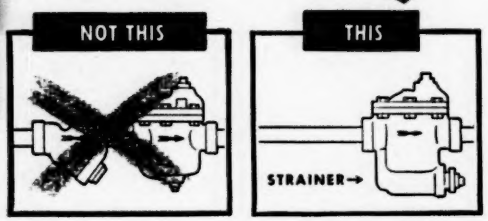
FIRST—THE ARMSTRONG No. 880
AND NOW—THE LARGER No. 881



VITAL STATISTICS



	No. 880	No. 881
Pipe Connections	½" or ¾"	½" or ¾"
Operating Pressure	150 psig	250 psig
Capacity, lbs. per hour continuous discharge	450-690	760-1060
Height	5⅞"	7 1/16"
Diameter	5"	5"
Weight	5 lbs.	6 lbs.



AN ECONOMICAL steam trap for draining small equipment naturally has a small discharge orifice. When dirt or scale conditions are bad it is recommended that a strainer be installed ahead of such a trap to avoid clogging.

Either the Armstrong No. 880 or No. 881 trap is a perfect answer for such a condition. In each the strainer is built right into the body, thereby eliminating a separate strainer, extra fittings and considerable installation labor. Best of all, these traps cost less than a standard trap plus a separate strainer. Look over your small trap applications and order the traps you need now from your local Armstrong representative's stock.

ARMSTRONG MACHINE WORKS
846 Maple Street • Three Rivers, Mich.

FOR COMPLETE DATA on correct selection and installation of steam traps for any service or any pressure, send for your copy of the 36-PAGE ARMSTRONG STEAM TRAP BOOK, or see our Catalog in Sweets or Chemical Engineering Catalog.

ARMSTRONG STEAM TRAPS

Good workmen + good tools + GOOD PIPE = GOOD JOB!

7 POINTS OF UNIFORM GOODNESS IN YOUNGSTOWN STEEL PIPE

- uniform ductility
- uniform lengths
- uniform threading
- uniform weldability
- uniform wall thickness and size
- uniform strength and toughness
- uniform roundness and straightness

QUALITY YOUNGSTOWN SERVICE

ON a radiant heating job, it's a pleasure to work with Youngstown pipe. It bends readily to a true arc without flattening. That's because it is uniformly soft and ductile, and soundly welded in manufacture by the Youngstown continuous-weld process. The name Youngstown, rolled into every length, is your assurance that it's GOOD PIPE.

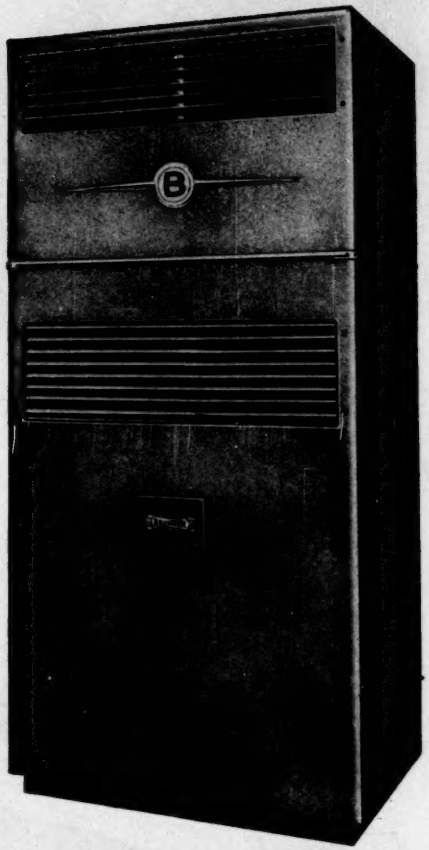
Youngstown
STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

Our dealers are doing business in a big way

WE'LL TELL YOU WHY...

BRUNNER SINCE 1906 AIR CONDITIONING



First of all Brunner Air Conditioning Units, both self contained and remote, are Brunner built. We have absolute control over every point and every design feature that contributes to their maximum efficiency.

Buyers know what they want. Air conditioning is no longer new and in a highly competitive field prospects will choose carefully. Brunner units are built for long, dependable, carefree operation and these qualities are instantly recognized in comparison.

Brunner has customer acceptance. This name is no stranger to folks who buy refrigeration and air conditioning.

Brunner takes care of their dealers. Modern factories, skilled workmen and specialized production lines give you what you want and when you want it.

THERE'S MUCH MORE TO BE TOLD so fill in below and our factory sales engineer will stop by with all the facts of why you could well be sharing in this profitable business. We'll send 1951 literature along at once.

CUT OUT AND MAIL

Name _____

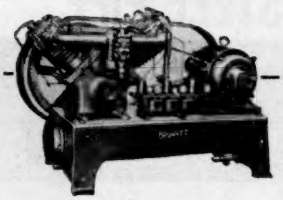
Company _____

Address _____

City and State _____

BRUNNER SINCE 1906 AIR CONDITIONING

- **Self Contained 3 HP. to 10 HP.**
- **Remote Type 3 HP. to 75 HP.**



BRUNNER MANUFACTURING CO., Utica 1, New York, U. S. A.

REFRIGERATION CONDENSING UNITS by BRUNNER SINCE 1906

AIR AND WATER COOLED MODELS—*a size and type for every purpose...* **¼ HP. TO 75 HP.**

HEATING AND VENTILATING

A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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2506 W. 8th Street.

Published by

THE INDUSTRIAL PRESS
148 Lafayette Street
New York 13, N. Y.

President
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Subscription Rates

Yearly subscription in the United States and Canada, one year, $3; two years, $5; three years, $6; in all other countries, $5 per year. Single copies 30 cents. Entered as second-class matter, April 18, 1925, at the Post Office, New York, N. Y., under the act of March 3, 1879.

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The contents of HEATING AND VENTILATING are indexed monthly by Industrial Arts Index and by Engineering Index.

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PUBLISHERS OF MACHINERY & MACHINERY'S HANDBOOK
The INDUSTRIAL PRESS

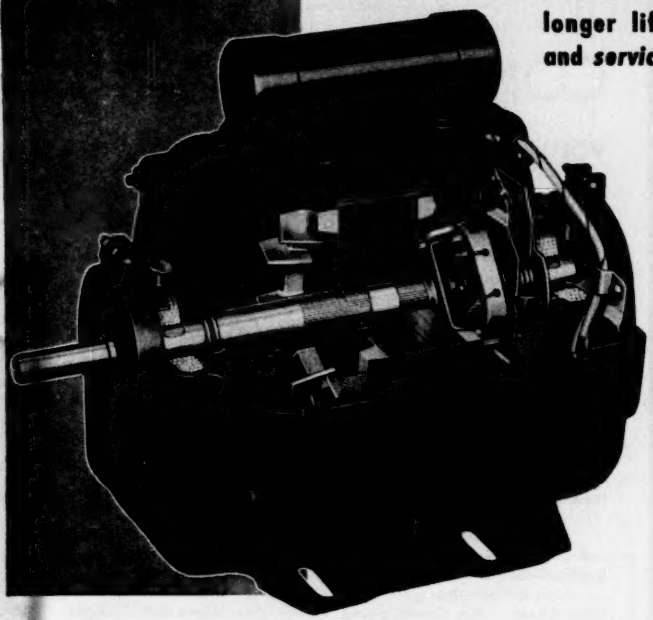
THIS MONTH'S COVER

Interior view of a steam-tube rotary dryer, courtesy of General American Transportation Company. See this month's Reference Section, Steps in the Selection of Drying Equipment, by S. J. Friedman, beginning page 95.

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

it *pays* to be particular about your choice of motors

Choose Wagner Motors for...



longer life . . . greater dependability and *service when and where it's needed!*

The selection of the *right* motor to power your product is all important. Uniform troublefree performance, dependable long-life operation, the reputation of the manufacturer, and his ability to provide immediate repair parts and service — *when* and *where* they're needed, are all factors that mean satisfied customers for you. You'll save time, money, and worry if you choose from the Wagner line because:

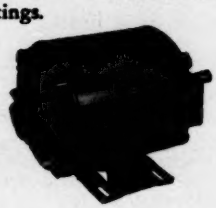
1. Wagner Motors are backed by a liberal warranty.
2. They are available in a wide range of types and sizes for every application.
3. Improved engineering features assure long life and efficient operation.
4. They are available from Wagner Branches in all principal cities.
5. More than 650 Wagner Authorized Service Stations and Parts Distributors plus 25 Wagner-owned Service Branches provide on-the-spot service, replacement motors, or genuine repair parts.

Regardless of what your motor requirements may be, Wagner can furnish the *right* motor to fit your need. Bulletin MU-185 gives complete information—write for your copy.

Wagner Capacitor-Start Motors

Wagner type RK motors are your best choice for use where capacitor-start fractional horsepower motors are desired. They are designed for use in applications where starting loads are fairly heavy, but which can be brought up to operating speed quickly.

They are available with either sleeve or ball bearings; in open or totally-enclosed types, with rigid or resilient bases or with a machined end plate for flange mounting. They are built in ⅛, ⅙, ¼, ⅓, ½, and ¾ horsepower ratings.



If you need motors in larger sizes, you can't beat the famous Wagner single-phase repulsion-start induction motor for low upkeep cost, freedom from vibration and noise, and years of reliable service. It's the standard by which all other single-phase motors are judged.

Wagner
Electric Corporation
1891 1951

WAGNER ELECTRIC CORPORATION
6463 Plymouth Ave., St. Louis 14, Mo., U.S.A.

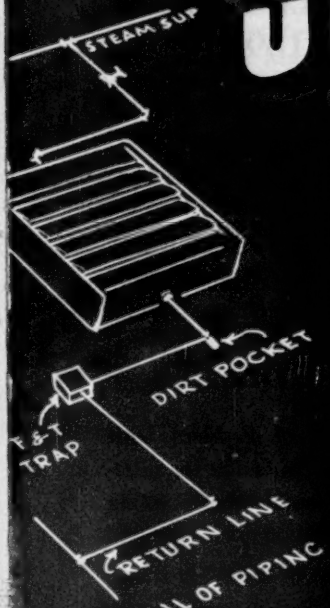
ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

MW-4

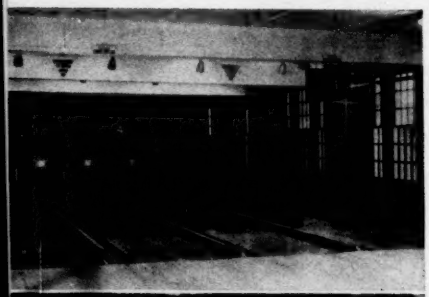
FEDDERS

UNIT HEATERS

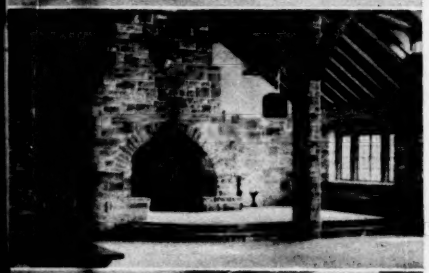


FEDDERS-QUIGAN CORPORATION, Buffalo 7, N. Y.

fedders UNIT HEATERS MAKE



Bowling Alleys



Public Recreation Rooms

Department Stores

Boat Building Plants

HEAT TRANSFER SPECIALISTS SINCE 1896

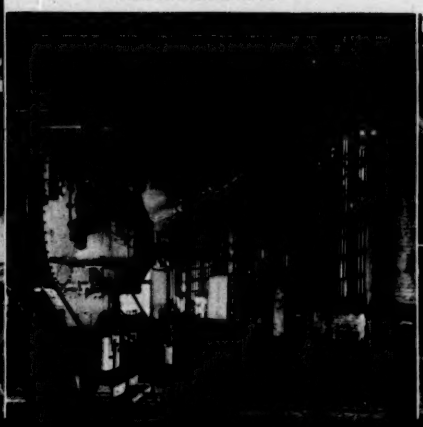
The performance of Fedders Unit Heaters is the result of over 50 years of specialized experience in designing and manufacturing heat transfer equipment. Fedders products are widely used in the automobile, electric refrigeration, air conditioning and heating fields.

ADVANCED DESIGN

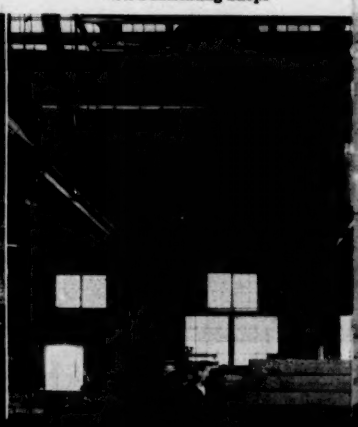
The advanced design of Fedders Unit Heaters has earned a reputation for satisfactory performance under the exacting conditions of industrial and commercial heating requirements everywhere.

FEDDERS-QUIGAN

Railroad Roundhouses



Steel Fabricating Shops



WARM FRIENDS EVERYWHERE

ADAPTABILITY

Their operating characteristics combine high heat transfer efficiency, directional placement of heat, quick warm-up, easy installation and quiet operation.

COMMERCIAL AND INDUSTRIAL APPLICATIONS

The attractive design and finish of Fedders unit heater cabinets makes them harmonize with the decorative treatment of modern plant, office, store and other interiors.

SAVE SPACE

They are well adapted to installations where floor and wall space is at a premium. For example, in modern supermarkets they release all shelf and floor space for profitable display and traffic use. Likewise, in factories they do not interfere with machinery, stock bins or materials handling systems.

100 TO 1,000 EDR

Fedders Unit Heaters are built in a well-graduated range of sizes and capacities for use with steam or hot water.

COMPACT, EFFICIENT HEATING

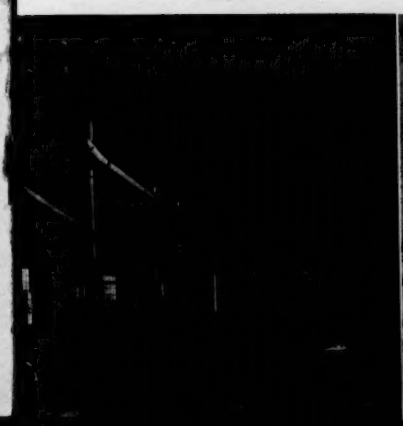
The photographs show typical installations under a wide variety of conditions where comfort is essential in the working zone.

COMPLETE DATA

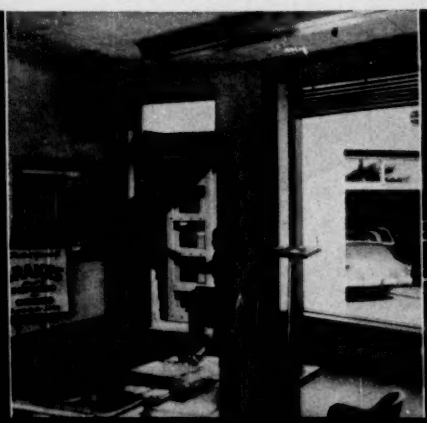
The following pages give complete performance data and specifications.

CORPORATION, BUFFALO 7, NEW YORK

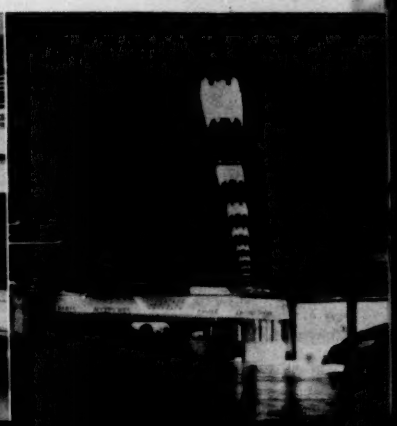
Machine Shops



Automobile Showrooms



Automobile Service Stations



fedders

The Inside Story of

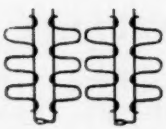
Men who specify, sell, install and use unit heaters appreciate their many engineering features which make Fedders Series 15 Unit Heaters give service—not require it. All-copper heating elements, streamline tubes and modern broad blade fans combine thermal and aero-dynamic efficiency. Complete protection against expansion stresses between heating element and cabinet as well as between individual tubes is an important factor contributing to life-long, trouble-free operation. They have been proved and approved in thousands of installations throughout business and industry.

ELECTRICALLY WELDED CABINET STRENGTH

Handsome, mono-piece cabinets combine light weight, ruggedness, rigidity and one-piece simplicity. Rich brown, morocco-like finish is baked on for permanence.

STREAMLINE COPPER TUBES

Tubes of 3:1 ratio provide quiet, streamlined air flow and efficient heat transfer.

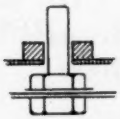


PATENTED SADDLE FINS

Fins are metallically bonded to each tube. Individual design of fins leaves each tube free to "give" laterally thus relieving differential expansion stresses between adjacent tubes,—an important design feature contributing to reliable, leakproof performance.

FLANGED HEADER OPENINGS

Deep, die formed flanges extruded into headers give abundant tube brazing area for maximum protection against leaks.

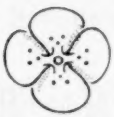


FULL-FLOATING ELEMENT MOUNTINGS

Expansion stresses between core assembly and cabinet are relieved by Fedders full-floating element mountings. This method of mounting eliminates hazards of forced bending of tubes under sudden changes in operating temperatures.

MAXIMUM COMFORT

Low final temperatures and high CFM assure ideal comfort conditions in working zone.



QUIET OPERATION

Latest type broad blade fans provide maximum air handling with minimum noise.

RESILIENT MOTOR MOUNTINGS

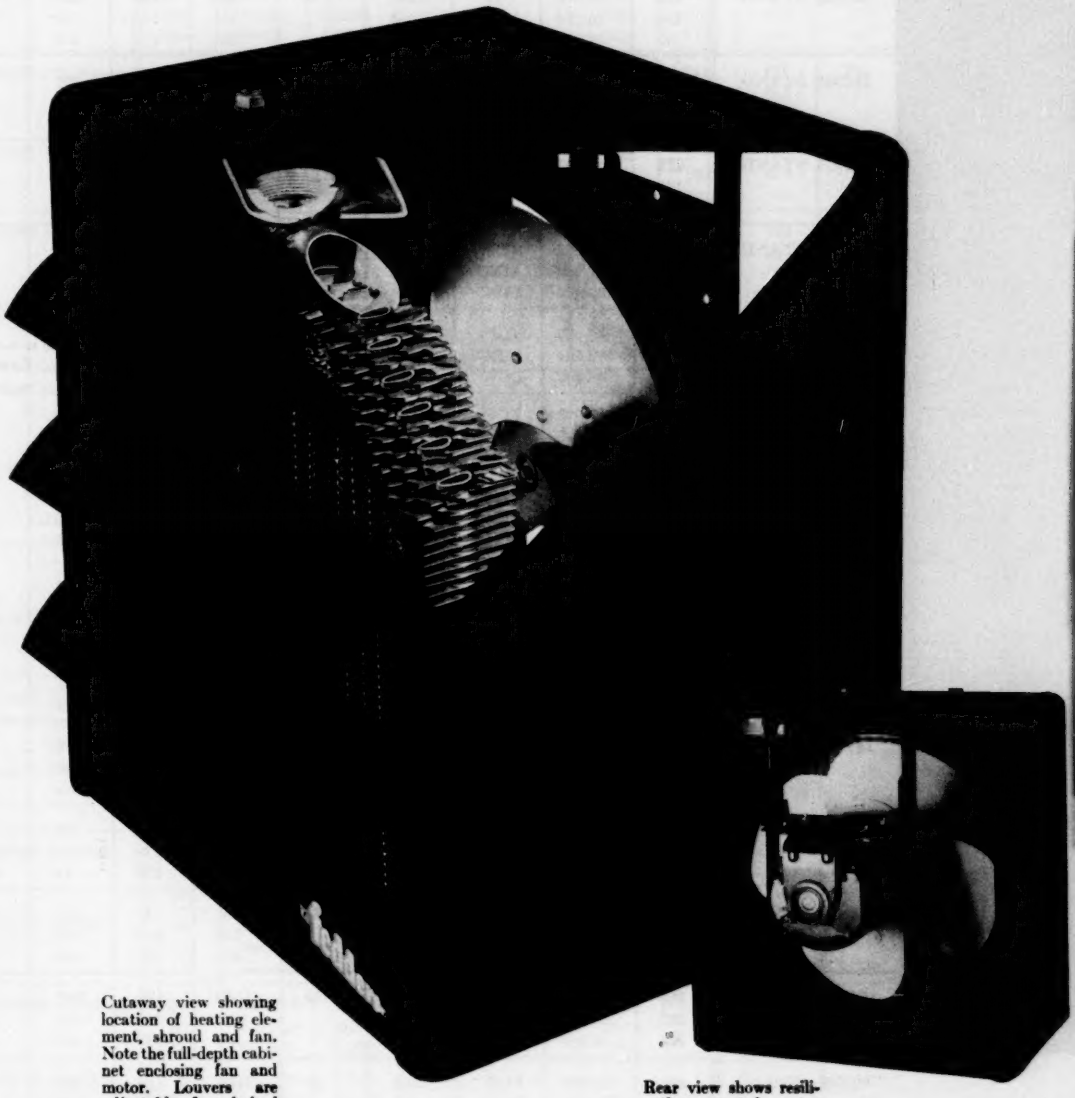
Motor and fan assembly are mounted in rubber to isolate vibration and deaden noise.

HEAT TRANSFER SPECIALISTS SINCE 1896

FEDDERS-QUIGAN CORPORATION, BUFFALO 7, N. Y.

fedders Series 15

UNIT HEATERS



Cutaway view showing location of heating element, shroud and fan. Note the full-depth cabinet enclosing fan and motor. Louvers are adjustable for desired placement of heat.

Rear view shows resiliently mounted motor and fan assembly.

FEDDERS-QUIGAN CORPORATION, BUFFALO 7, N. Y.

fedders

CAPACITY DATA

fedders

SERIES 15 UNIT HEATERS

BASED ON 2 LBS. STEAM PRESSURE AT HEATER AND 60° F. ENTERING AIR

MODEL No.	CAPACITY		MOTOR			AIR			
	E.D.R.	B.T.U. /Hr.	Speed	R.P.M.	H.P.	C.F.M. 70° F.	Final Temp.	Outlet Air Vel., F.P.M.	Cond. Lbs./Hr.
15B100 STAND.	**100**	**24.000**	**TOP**	**1500**	**1/30**	**420**	**113**	**715**	**25**
	87	20,900	MED	1160		325	122	552	22
	72	17,300	LOW	860		240	129	410	18
15B125 STAND.	**125**	**30.000**	**TOP**	**1500**	**1/30**	**510**	**108**	**995**	**32**
	109	26,200	MED.	1160		395	113	760	27
	93	22,300	LOW	860		292	121	570	23
15C150 STAND.	**150**	**36.000**	**TOP**	**1500**	**1/30**	**597**	**116**	**705**	**37**
	130	31,200	MED.	1160		462	122	544	32
	109	26,200	LOW	860		342	129	404	27
15C175 STAND.	**175**	**42.000**	**TOP**	**1500**	**1/30**	**785**	**111**	**900**	**44**
	153	36,700	MED.	1160		606	115	695	38
	129	30,900	LOW	860		450	123	516	32
15D200 STAND.	**200**	**48.000**	**TOP**	**1140**	**1/20**	**817**	**114**	**730**	**50**
	163	39,200	MED.	800		572	123	512	41
	135	32,400	LOW	600		430	130	384	34
HIGH SPEED	200	48,000	TOP	1500	1/30	820	114	731	50
	173	40,500	MED.	1160		632	121	573	43
	145	34,800	LOW	860		470	128	418	36
SLOW SPEED	175	42,000	TOP	860	1/30	617	123	640	44
	121	29,000	MED.	600		430	127	446	30
	106	25,400	LOW	470		337	132	350	26
15E250 STAND.	**250**	**60.000**	**TOP**	**1140**	**1/20**	**1038**	**113**	**780**	**62**
	200	48,000	MED.	800		548	122	730	50
	176	42,300	LOW	600		412	129	546	44
HIGH SPEED	250	60,000	TOP	1600	1/20	1040	113	781	62
	219	52,600	MED.	1250		812	119	55	610
	180	43,200	LOW	900		585	127	45	438
SLOW SPEED	220	52,500	TOP	860	1/30	784	122	685	54
	180	43,200	MED.	600		546	125	478	45
	156	37,400	LOW	470		424	131	374	39
15F300 STAND.	**300**	**72.000**	**TOP**	**1140**	**1/20**	**1195**	**116**	**770**	**74**
	239	57,400	MED.	800		838	122	540	60
	211	50,700	LOW	600		628	129	406	53
HIGH SPEED	300	72,000	TOP	1600	1/12	1180	117	760	74
	264	63,500	MED.	1250		922	119	66	592
	216	51,800	LOW	900		664	128	54	428
SLOW SPEED	260	62,500	TOP	860	1/30	905	124	675	65
	210	50,400	MED.	600		632	125	472	53
	183	44,000	LOW	470		494	131	369	46
15F350 STAND.	**350**	**84.000**	**TOP**	**1140**	**1/12**	**1540**	**111**	**920**	**86**
	308	74,000	MED.	800		1080	116	654	77
	234	56,200	LOW	600		810	122	494	58
SLOW SPEED	295	70,800	TOP	860	1/30	1160	114	698	73
	238	57,200	MED.	600		815	120	492	59
	204	49,400	LOW	470		635	126	390	51

Heat Transfer Specialists Since 1896

fedders

SERIES 15 UNIT HEATERS

CAPACITY DATA

fedders

BASED ON 2 LBS. STEAM PRESSURE AT HEATER AND 60°F. ENTERING AIR

MODEL No.	CAPACITY		MOTOR			AIR			
	E.D.R.	B.T.U. /Hr.	Speed	R.P.M.	H.P.	C.F.M. 70° F.	Final Temp.	Outlet Air Vel., F.P.M.	Cond. Lbs./Hr.
15G400 STAND.	**400**	**96,000**	**TOP**	**1140**	**1/20**	**1510**	**118**	**780**	**99**
	319	76,700	MED.	800		1060	122	547	80
	282	67,600	LOW	600		794	129	411	70
SLOW SPEED	350	84,000	TOP	860	1/30	1140	123	685	87
	308	74,000	MED.	600		796	128	478	77
	265	63,600	LOW	470		623	131	374	66
15G450 STAND.	**450**	**108,000**	**TOP**	**1140**	**1/12**	**1680**	**117**	**815**	**111**
	333	79,900	MED.	800		1180	120	566	82
	296	71,000	LOW	600		885	127	430	73
SLOW SPEED	379	91,000	TOP	860	1/12	1270	119	608	94
	321	77,000	MED.	600		890	123	428	79
	279	67,000	LOW	470		682	127	338	68
15H500 STAND.	**500**	**120,000**	**TOP**	**1140**	**1/12**	**1988**	**116**	**750**	**124**
	410	98,400	MED.	800		1390	123	527	102
	337	80,800	LOW	600		1042	130	395	84
SLOW SPEED	435	104,500	TOP	860	1/12	1503	124	660	109
	353	84,800	MED.	600		1050	126	460	88
	307	73,600	LOW	470		823	131	361	77
15J600 STAND.	**600**	**144,000**	**TOP**	**1140**	**1/8**	**2490**	**114**	**815**	**149**
	494	119,000	MED.	800		1750	120	572	124
	416	99,800	LOW	600		1310	127	424	104
SLOW SPEED	520	125,000	TOP	860	1/12	1885	121	715	130
	427	102,500	MED.	600		1315	123	498	107
	366	88,000	LOW	470		1030	129	391	93
15K700 STAND.	**700**	**168,000**	**TOP**	**1140**	**1/6**	**3190**	**109**	**780**	**175**
	575	138,000	MED.	800		2240	121	547	144
	485	116,600	LOW	600		1680	128	412	121
SLOW SPEED	640	154,300	TOP	860	1/12	2410	119	600	161
	517	124,000	MED.	600		1680	127	418	129
	425	104,000	LOW	470		1320	133	328	106
15K800 STAND.	**800**	**192,000**	**TOP**	**1140**	**1/4**	**3500**	**111**	**725**	**199**
	660	158,500	MED.	800		2460	124	510	165
	572	137,400	LOW	600		1840	130	382	143
SLOW SPEED	695	167,000	TOP	860	1/8	2630	118	635	174
	562	135,200	MED.	600		1830	126	443	141
	462	111,000	LOW	470		1440	132	347	116
15L900 STAND.	**900**	**216,000**	**TOP**	**1140**	**1/4**	**3780**	**113**	**790**	**225**
	740	177,600	MED.	800		2650	119	554	185
	622	149,200	LOW	600		1990	129	416	155
SLOW SPEED	800	192,000	TOP	860	1/8	2860	122	610	199
	646	155,000	MED	600		2000	127	425	162
	558	134,000	LOW	470		1565	133	333	140
15L1000 STAND.	**1000**	**240,000**	**TOP**	**1140**	**1/3**	**4520**	**110**	**920**	**248**
	832	199,600	MED.	800		3170	117	645	207
	706	169,500	LOW	600		2380	124	484	177
SLOW SPEED	870	209,000	TOP	860	1/6	3420	116	806	217
	717	172,200	MED.	600		2390	120	562	180
	618	148,500	LOW	470		1180	127	440	155

HEAT TRANSFER SPECIALISTS SINCE 1896

fedders

fedders CONVERSION FACTORS

FOR DETERMINING CAPACITIES FOR VARIOUS STEAM PRESSURES AND ENTERING AIR TEMPERATURES (BASED ON STANDARD CONDITIONS OF 2 LBS. GAGE STEAM PRESSURE AND 60°F ENTERING AIR TEMPERATURE)

Steam Pressure Lbs. per Sq. In. Gauge	Latent Heat of Steam	Temperature of Steam Degrees F.	TEMPERATURE OF ENTERING AIR											
			—10°	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
0	970.2	212.0	....	....	....	....	....	1.110	1.034	0.956	0.881	0.809	0.739	0.671
2	966.1	218.5	....	....	....	....	....	1.155	1.076	1.000	0.926	0.853	0.782	0.713
5	960.7	227.2	1.640	1.550	1.456	1.370	1.289	1.206	1.127	1.050	0.974	0.901	0.829	0.760
10	952.4	239.4	1.730	1.639	1.545	1.460	1.375	1.290	1.211	1.131	1.056	0.982	0.908	0.838
15	945.5	249.7	1.799	1.708	1.614	1.525	1.441	1.335	1.275	1.194	1.117	1.043	0.970	0.897
20	939.3	258.8	1.861	1.769	1.675	1.584	1.498	1.416	1.333	1.251	1.174	1.097	1.024	0.952
30	928.5	274.1	1.966	1.871	1.775	1.684	1.597	1.509	1.429	1.346	1.266	1.190	1.115	1.042
40	919.3	286.7	2.058	1.959	1.862	1.771	1.683	1.596	1.511	1.430	1.349	1.270	1.194	1.119
60	903.9	307.3	2.196	2.094	1.997	1.902	1.811	1.725	1.640	1.555	1.472	1.393	1.314	1.239
80	891.1	329.9	2.312	2.211	2.112	2.015	1.925	1.836	1.748	1.660	1.577	1.497	1.418	1.342
100	880.2	337.9	2.409	2.307	2.204	2.108	2.015	1.927	1.836	1.749	1.633	1.581	1.502	1.424
125	867.8	352.9	2.518	2.408	2.309	2.213	2.123	2.025	1.936	1.848	1.760	1.675	1.596	1.516
150	856.9	365.9	2.610	2.498	2.393	2.294	2.198	2.105	2.015	1.925	1.842	1.758	1.673	1.596

To determine capacity at any Steam Pressure and Entering Air Temperature, multiply rated capacity at 60° F. Entering Air Temperature and 2 Pounds Steam Pressure by correct factor from table above.

PROPERTIES OF SATURATED STEAM

Gauge Pressure Lbs. Sq. In.	Temperature Degrees F.	Latent Heat B.T.U./Lb.	Gauge Pressure Lbs. Sq. In.	Temperature Degrees F.	Latent Heat B.T.U./Lb.
0	212.0	970.2	60	307.3	903.9
1	215.3	968.2	65	311.8	900.5
2	218.5	966.2	70	316.0	897.3
3	221.5	964.3	75	320.1	894.0
4	224.4	962.4	80	323.9	891.1
5	227.2	960.5	85	327.6	888.2
6	229.8	958.8	90	331.2	885.4
7	232.4	957.2	95	334.6	882.6
8	234.8	955.6	100	337.9	880.0
9	237.1	954.0	105	341.1	877.4
10	239.4	952.5	110	344.2	874.9
15	249.7	945.5	115	347.2	872.5
20	258.8	939.3	120	350.1	870.0
25	266.9	933.6	125	352.9	867.8
30	274.1	928.5	130	355.7	865.5
35	280.6	923.8	135	358.3	863.3
40	286.7	915.1	140	360.9	861.1
45	292.4	913.3	145	363.4	859.0
50	297.7	911.2	150	365.9	856.9
55	302.6	907.4			

HEAT TRANSFER SPECIALISTS SINCE 1896

STANDARD HOT WATER CAPACITIES

200°F. ENTERING WATER TEMPERATURE-60°F. ENTERING AIR TEMPERATURE

fedders

FOR 20° WATER TEMPERATURE DROP

Model No.	CAPACITY		MOTOR		AIR			WATER	
	Sq. Ft. E.D.R. (150B.T.U./Hr. per Sq. Ft.)	B.T.U. per Hr.	R.P.M.	H.P.	C.F.M. @ 70° F.	Final Temp.	Outlet Air Velocity	Flow G.P.M.	Pressure Drop Millinches
15 B100	90	13,400	1500	1/30	420	90	686	1.4	300
15 B125	110	16,500	1500	1/30	510	91	965	1.7	370
15 C150	143	21,400	1500	1/30	597	94	666	2.2	530
15 C175	159	23,800	1500	1/30	785	89	865	2.5	610
15 D200	202	30,300	1140	1/20	817	95	706	3.1	700
15 E250	246	37,000	1140	1/20	1038	94	754	3.8	2,050
15 F300	290	43,500	1140	1/20	1195	95	742	4.5	2,080
15 F350	333	49,600	1140	1/12	1540	91	890	5.1	2,610
15 G400	371	56,000	1140	1/20	1510	95	747	5.8	1,660
15 G450	396	59,500	1140	1/12	1680	94	778	6.2	1,860
15 H500	528	79,300	1140	1/12	1988	98	727	8.2	3,870
15 J600	627	94,200	1140	1/8	2490	96	790	9.7	3,470
15 K700	795	119,200	1140	1/6	3190	96	762	12.3	4,980
15 K800	826	124,000	1140	1/4	3500	94	704	12.9	5,320
15 L900	1040	156,000	1140	1/4	3780	100	772	16.1	6,020
15 L1000	1140	171,000	1140	1/3	4520	96	895	17.6	8,050

FOR 10° WATER TEMPERATURE DROP

15 B100	110	15,800	1500	1/30	420	95	690	3.3	1,220
15 B125	137	19,800	1500	1/30	510	96	974	4.1	1,780
15 C150	173	24,600	1500	1/30	597	99	672	5.1	2,100
15 C175	197	28,300	1500	1/30	785	94	873	5.8	2,640
15 D200	243	35,000	1140	1/20	817	100	712	7.2	3,940
15 E250	293	42,200	1140	1/20	1038	98	760	8.7	5,970
15 F300	346	50,000	1140	1/20	1195	99	748	10.3	8,090
15 F350	396	57,000	1140	1/12	1540	95	900	11.7	11,400
15 G400	547	63,400	1140	1/20	1510	100	755	13.0	5,820
15 G450	472	68,000	1140	1/12	1680	98	786	14.0	6,520
15 H500	612	88,400	1140	1/12	1988	102	735	18.2	11,400
15 J600	740	106,000	1140	1/3	2490	100	798	21.9	14,200
15 K700	915	131,000	1140	1/6	3190	99	770	27.0	19,400
15 K800	953	137,000	1140	1/4	3500	97	710	28.2	21,100
15 L900	1180	170,000	1140	1/4	3780	102	778	35.0	30,800
15 L1000	1290	185,000	1140	1/3	4520	99	902	38.2	38,800

NOTE: Satisfactory performance of Fedders Series 15 Unit Heaters with hot water as the heating medium requires:

1. Positive circulation of the water by means of a pump or circulator.
2. A minimum entering water temperature of 160° F.

CONVERSION FACTORS FOR DETERMINING HOT WATER CAPACITIES OF FEDDERS SERIES 15 UNIT HEATERS

for various inlet water temperatures and entering air temperatures. (Based on standard conditions of 200°F. entering water and 60°F. entering air).

Entering Air ° F.	ENTERING WATER TEMPERATURES ° F.								
	160°	170°	180°	190°	200°	210°	220°	230°	240°
30	0.93	1.00	1.07	1.14	1.21	1.29	1.36	1.43	1.50
40	0.86	0.93	1.00	1.07	1.14	1.21	1.29	1.36	1.43
50	0.79	0.86	0.93	1.00	1.07	1.14	1.21	1.29	1.36
60	0.71	0.79	0.86	0.93	1.00	1.07	1.14	1.21	1.29
70	0.64	0.71	0.79	0.86	0.93	1.00	1.07	1.14	1.21
80	0.57	0.64	0.71	0.79	0.86	0.93	1.00	1.07	1.14
90	0.50	0.57	0.64	0.71	0.79	0.86	0.93	1.00	1.07
100	0.43	0.50	0.57	0.64	0.71	0.79	0.86	0.93	1.00

To determine the capacity of a Fedders Unit Heater using hot water at entering water and air temperatures other than 200°F. water and 60°F. air, multiply the rated hot water capacity by the correct factor from table above.

HEAT TRANSFER SPECIALISTS SINCE 1896

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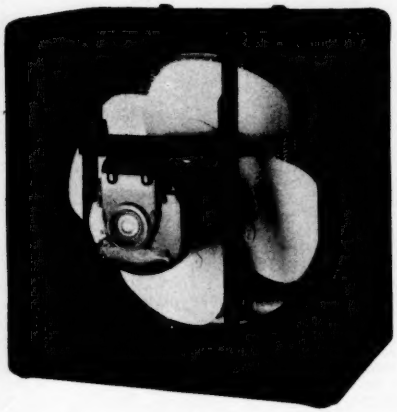
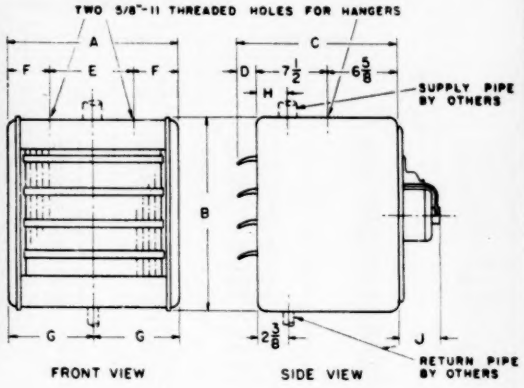
DIMENSIONS fedders Series 15 UNIT HEATERS





Note:—Dimensions shown hereon correct at time of catalog publication. However, because our policy is one of continuous improvement, we reserve the right to make minor changes in specifications or dimensions without incurring obligation. Purchaser may request certified dimension print if necessary for a particular job.

DIMENSIONAL DATA

Unit Model No.	A	B	C	D	E	F	G	H	J App.	Supply Conn. F.P.T.	Return Conn. F.P.T.	Fan Dia.	Approx. Net Wt.	Approx. Ship. Wt.
15B100	13 3/4	14 1/8	15 1/4	1 1/8	8 1/2	2 5/8	6 7/8	2 3/8	2 1/4	1	1	10	46	65
15B125	13 3/4	14 1/8	15 1/4	1 1/8	8 1/2	2 5/8	6 7/8	2 3/8	2 1/4	1	1	10	46	65
15C150	15 7/8	16 1/8	15 1/4	1 1/8	8 1/2	3 11/16	7 15/16	2 3/8	2 1/4	1	1	12	54	75
15C175	15 7/8	16 1/8	15 1/4	1 1/8	8 1/2	3 11/16	7 15/16	2 3/8	2 1/4	1	1	12	54	75
15D200	17 1/4	19 3/8	16 1/4	2 1/8	8 1/2	4 3/8	8 3/8	2 3/8	5 3/8	1 1/2	1	14	87	113
15E250	20	19 3/8	16 1/4	2 1/8	11 1/2	4 1/4	10	2 3/8	5 3/8	1 1/2	1	14	93	126
15F300	20	21 3/8	16 1/4	2 1/8	11 1/2	4 1/4	10	2 3/8	5 3/8	1 1/2	1	16	97	130
15F350	20	21 3/8	16 1/4	2 1/8	11 1/2	4 1/4	10	2 3/8	5 3/8	1 1/2	1	16	97	130
15G400	22	23 3/8	16 1/4	2 1/8	13	4 1/2	11	2 11/16	5 3/8	2	1 1/2	18	109	149
15G450	22	23 3/8	16 1/4	2 1/8	13	4 1/2	11	2 11/16	5 3/8	2	1 1/2	18	109	149
15H500	23 3/8	27 7/8	16 1/4	2 1/8	13	5 3/16	11 11/16	2 11/16	5 3/8	2	1 1/2	20	125	168
15J600	26 1/8	27 7/8	16 1/4	2 1/8	13	6 9/16	13 1/16	2 11/16	6 3/8	2	1 1/2	20	133	178
15K700	29 5/8	31 7/8	16 1/4	2 1/8	16	6 13/16	14 13/16	2 11/16	6 15/16	2	1 1/2	24	159	212
15K800	29 5/8	31 7/8	16 1/4	2 1/8	16	6 13/16	14 13/16	2 11/16	6 15/16	2	1 1/2	24	159	212
15L900	34 3/8	31 7/8	16 1/4	2 1/8	16	9 3/16	17 3/16	2 11/16	6 15/16	2	1 1/2	26	199	258
15L1000	34 3/8	31 7/8	16 1/4	2 1/8	16	9 3/16	17 3/16	2 11/16	6 15/16	2	1 1/2	26	199	258

HEAT TRANSFER SPECIALISTS SINCE 1896

GENERAL SPECIFICATIONS

fedders

1. Ratings are based on tests made in accordance with the "Standard Code for Testing and Rating Steam Heaters" adopted by the Industrial Unit Heater Association and the American Society of Heating and Ventilating Engineers.

2. Ratings are true only when units are recirculating air with free inlet and discharge.

3. Capacities are based on 2 lb. steam pressure at the unit and 60° F. entering air temperature.

4. The C.F.M. is based on entering air at 60° F. and is corrected to standard air weighing .07488 lbs. per cubic foot, which corresponds to dry air at 70° F.

5. Outlet velocity is based on the delivery face area of the heating element and the final temperatures obtained with 2 lbs. steam pressure and 60° F. entering air.

6. The copper heating element will withstand operating saturated steam pressure up to 150 pounds gauge. It is preferable, however, to operate on pressures below 30 pounds gauge. See note 13.

7. When unit heaters are to handle air at temperatures below freezing, not less than 5 lbs. gauge must be maintained at the unit.

8. Unit Heaters are preferably supported by hangers made from 5/8" diameter rods or some other means.

9. Series 15 Unit Heaters are equipped with G.E., Century and other nationally known motors. Waste packed sleeve bearings and thrust bearings are standard.

10. Single speed motors are not furnished with switches at the list price.

11. All single phase motors may be used on any one phase of two or three phase circuits of the same frequency.

12. Before putting a unit heater into operation, make sure that the motor bearings are free and that they have sufficient oil. Oil not less than every 90 operating days.

13. Fedders heating products herein listed are warranted to be free from defects in material and workmanship under normal conditions and service when made part of a properly functioning heating system; and our obligation under this warranty is limited to making good at our factory any part or parts thereof which shall, within one year from date of shipment from our factory, be returned to our factory with all transportation charges prepaid and which our examination shall disclose to have been defective. For purpose of this guarantee, normal conditions and service require boiler water maintained at normal alkalinity and atmosphere uncontaminated with corrosive gases.

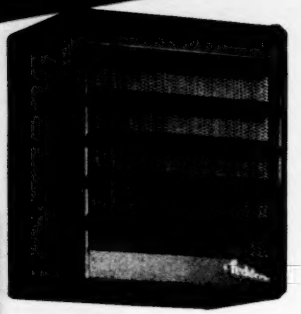
This warranty does not apply to any equipment which shall have been repaired or altered outside of our factory in a way so as, in our judgment, to affect its stability, nor which has been subject to misuse, negligence, or operating conditions in excess of those stated herein.

This warranty does not cover any labor charges for replacement of any part or parts, adjustments, repairs, or any work done whatsoever, nor does it assume responsibility of consequential damages of any nature, and the purchaser or user, by acceptance of this equipment assumes the responsibility for the consequences of its use or misuse. Equipment and parts made by others are subject to the warranty of their respective manufacturers.

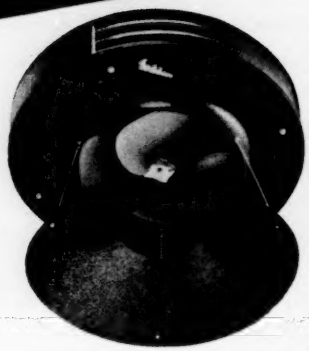
14. The right to change specifications without notice is hereby reserved.

Heat Transfer Specialists Since 1896

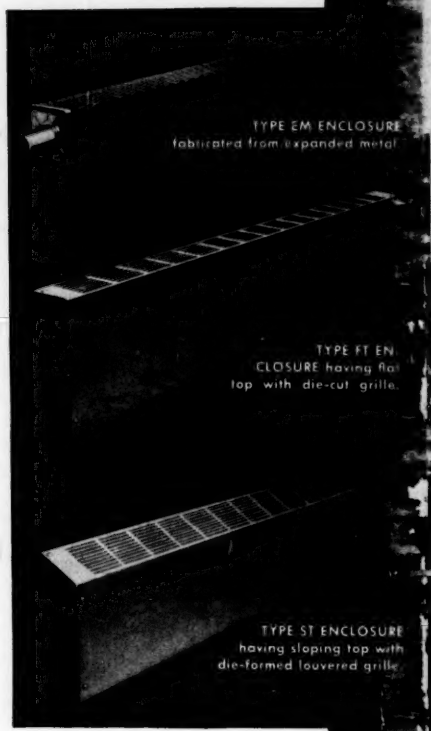
fedders



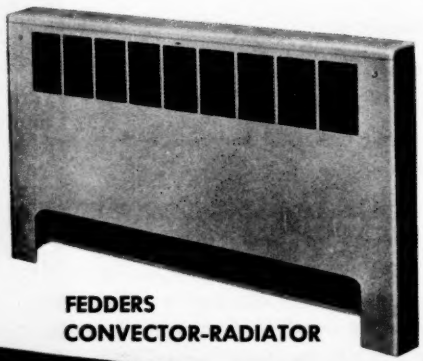
FEDDERS Series 15 UNIT HEATER



FEDDERS DOWN BLOW UNIT HEATER


TYPE EM ENCLOSURE fabricated from expanded metal.
TYPE FT EN CLOSURE having flat top with die-cut grille.
TYPE ST ENCLOSURE having sloping top with die-formed louvered grille.

FEDDERS WALL RADIATION



FEDDERS CONVECTOR-RADIATOR

FEDDERS BASEBOARD RADIATION

"... $26,500,000 worth of U.S. Savings Bonds a year under company Payroll Savings Plan..."

CHARLES E. WILSON

"General Electric employees are buying more than $26,500,000 worth of U. S. Savings Bonds a year under company payroll savings plans. Since the inception of our savings plans in 1917, General Electric employees have saved $445,000,000 of which $280,000,000 consisted of the purchase of United States Savings Bonds since May, 1941. The record speaks for itself."

The record of General Electric Company, and the records of more than 21,000 other large companies, prove that employees *want* to save the easy, automatic way—the Payroll Savings Plan.

As of November 1, 1950, more than 8,000,000 employees were buying U. S. Savings Bonds *every month*. While the figure was impressive, it was not as large as it should have been—a fact recognized by many companies.

In November and December, top executives of literally thousands of large companies (employing one hundred or more) decided to check their Payroll Savings Plan and endeavor to increase participation to 60% or more.

Here are a few December reports: in one of the larger units of a leading steel corporation, participation went from 20% to 80.6 per cent . . . a well-known independent steel company (13,710 employees) reported 82% participation . . . another large steel company (100,000 employees), 75% participation . . . one plant of a large rubber corporation climbed to 94% (company average, all plants, 70%—and still going up). Tabulation of all companies exceeding 60% participation in December would literally fill this page.

Higher participation in the Payroll Savings Plan is good for the men and women for whom it builds security. It is good for the company because a saving employee is a better workman, a better citizen. It is good for the country because the month after month purchase of U. S. Savings Bonds by millions of Americans is a most effective check on inflationary tendencies.

Phone, write or wire, now, to Savings Bond Division, U. S. Treasury Department, Suite 700, Washington Building, Washington, D.C. Your State Director has a simple, four-point promotion plan, concluding with a person to person canvass that puts a Payroll Savings Application Blank in the hands of every employee. That's all you have to do—and you'll be surprised at the response from employees who *want* to save.

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the Advertising Council and

HEATING and VENTILATING

reasons why

FOR THE MAN WHO HAS TO SPECIFY

To the man with the responsibility of choice comes the daily problem of getting the right equipment for specific requirements. More and more of these men are finding that AAF has a keen appreciation of their needs. This is evidenced by a line—largest in the world—that is engineered to meet particular needs. It isn't necessary to make-do . . . AAF provides many different types of air treatment units, many different sizes and capacities, many times better in engineering refinements to *solve your problems.*

Whether you happen to be specifying for a factory, department store or school building, consider the products of AAF and the Herman Nelson Division. They are engineered and built to make life easier for the man who has to specify.

AAF

American Air Filter

COMPANY INC.,

HERMAN NELSON DIVISION

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PLANTS: LOUISVILLE, KENTUCKY MOLINE, ILLINOIS

AAF OFFERS ELECTRONIC PRECIPITATION

- To capture the smallest of particles, down—way down, on the micron scale.
- In three distinct types—automatic, washable and dry types.
- A wide range of sizes to meet all space and capacity requirements.

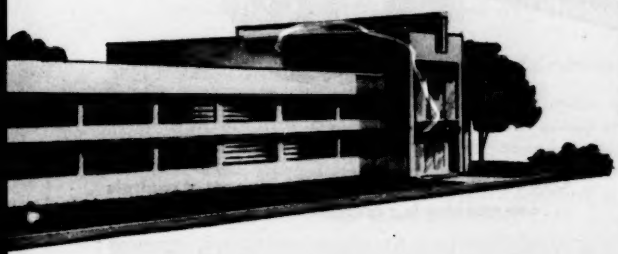
AAF OFFERS ALL TYPES OF AIR FILTRATION

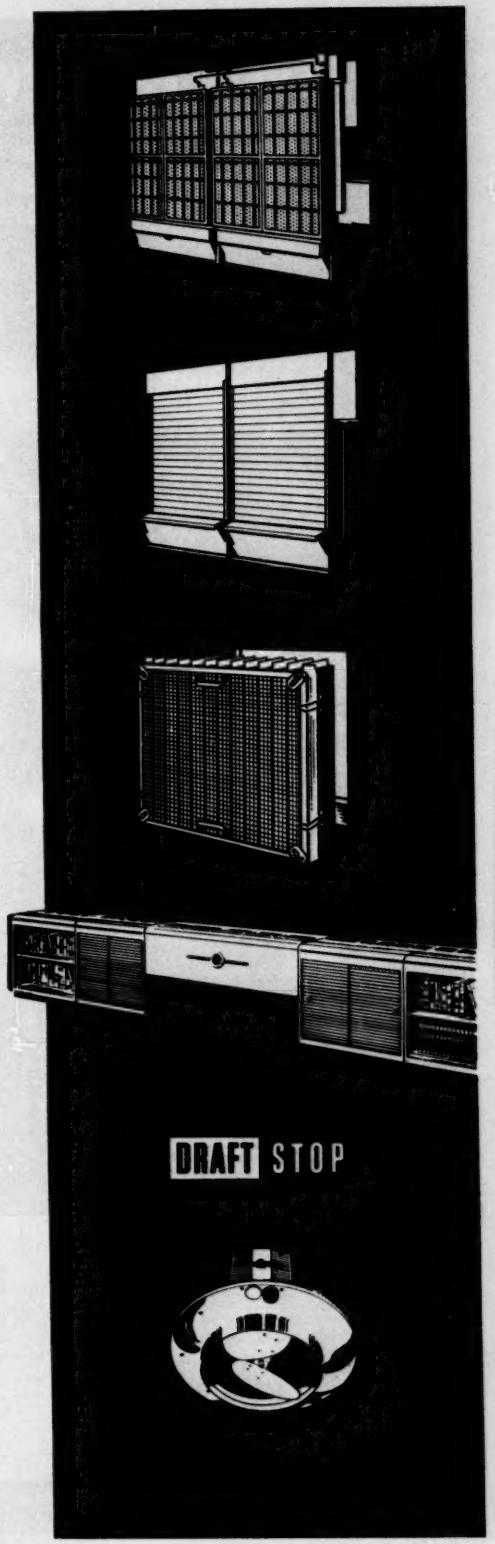
- To provide clean air for all practical purposes.
- In many types including automatic, viscous and dry types; washable, replaceable and renewable, viscous and dry type units.
- Wide selection of sizes and capacities to meet all air cleaning requirements.

Whatever the need for clean air, whenever you specify air cleaning equipment, remember AAF offers selective air filtration based on long-term experience. For consultation on air treatment problems or specific data for your files, write to the address below.

NOW WE OFFER A WAY TO END "DRAFT ROW" IN THE CLASSROOMS

With Herman Nelson's introduction of the DRAFT|STOP System classroom ventilation is absolutely revolutionized. By trapping drafts at the source, introducing fresh air and maintaining healthful temperatures automatically, pupils avoid one threat of illness, are actually more receptive to teaching. This most-modern, most-advanced method of keeping classroom air in the best of condition for health and comfort is available now. Specify DRAFT|STOP for every school you plan.



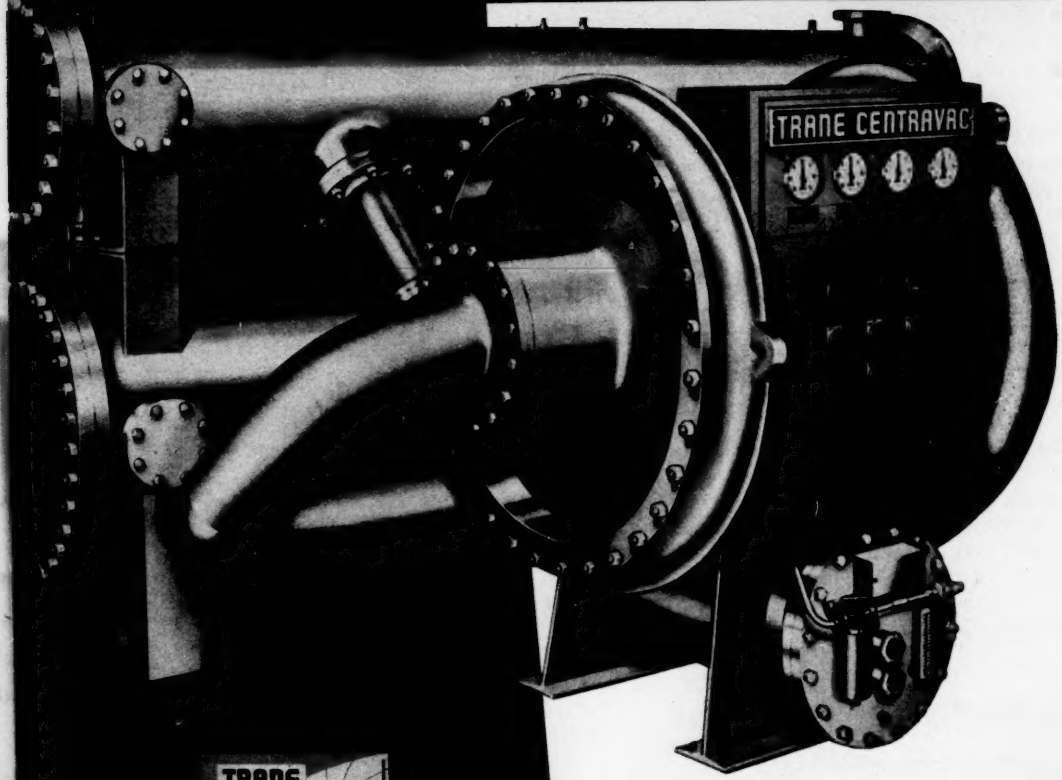


LIKE NEW THINGS WITH OLD-FASHIONED VALUE?

Here's the new Vertical Fan-Type Unit Heater. It's built to the same standards of value that have won Herman Nelson a reputation for quality heating products. For steam and hot water, its rugged construction means long economical service. Request detailed information on our complete Herman Nelson Unit Heater line.

HERE'S THE NEW

TRANE CenTraVac...



One installation, one wiring job, one set of controls . . . one machine is a complete refrigeration system.

Now . . . better-than-ever results from the systems you design or install . . . with a CenTraVac, the completely new Trane Centrifugal Refrigeration Unit.

Now . . . for the first time . . . a centrifugal design engineered for practical air conditioning and process cooling requirements with models ranging in capacity from 45 to 190 tons of refrigeration.

Flexible capacity control, proportionate power reduction, hermetically sealed construction—these exclusive features are only a few of the outstanding basic improvements available only in the great new Trane CenTraVac Centrifugal Refrigeration Units.

For complete literature and full information contact the Trane Field Representative in your area or write to The Trane Company, La Crosse, Wisconsin, for Bulletin S-399.

MANUFACTURING ENGINEERS OF HEATING

it's more than a compressor!

Complete centrifugal refrigeration unit cuts costs four ways

For the first time, a centrifugal unit furnishes chilled water for installations as low as 45 tons! The CenTraVac is the only centrifugal designed for smaller jobs as well as the bigger ones. A new kind of centrifugal—with hermetically sealed direct drive—with stable operation from 100% down to 10% of rated capacity—with reduced power consumption under reduced capacity operation.

Big Power Savings On Jobs As Low As 45 Tons!

When less cooling is demanded by the system, the CenTraVac automatically lowers capacity. Horsepower per ton reduction parallels capacity reduction over wide operating ranges. Owner pays only for cooling actually used by the system, thanks to CenTraVac built-in capacity control and the new Trane power reduction feature.

Simplified Installation Slashes Costs!

Compact, lightweight CenTraVac can be located conveniently in building without special mounting foundations. Smooth running, quiet operation eliminates need for isolation. Then, too, *one* wiring job, *one* set of connections, *one* system of controls is all that is required. The CenTraVac is a hermetically sealed unit containing the compressor, the condenser and the evaporator for the complete chilled water system!

Maintenance Time and Expense Eliminated!

The CenTraVac is designed to run without special attention. Impellers mounted directly on shaft of water-cooled, hermetically enclosed motor eliminate troublesome shaft seals, gear boxes, unnecessary bearings. Forced-feed oil system is designed for positive lubrication of two main bearings, the only bearings in the entire machine. Turn it on, turn it off, as often as necessary, or let it run continuously season after season.

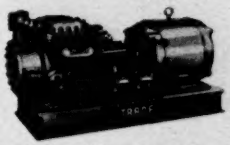
High Efficiency Means Low Cost Cooling!

Less than one horsepower per ton required for usual air conditioning applications! Under varying loads the tonnage-to-horsepower ratio often averages out even more favorably.

The CenTraVac supplies lowest cost chilled water for smaller jobs as well as big ones. Five models to choose from between 45 and 190 tons!

This great new Trane line makes centrifugal refrigeration available—for the first time—in the capacities required for the majority of practical air conditioning and process cooling applications!

New Trane Self-Contained Air Conditioner! Brand new design packs greater capacity into small cubic space, produces more cooling, yet occupies less floor area. See new Trane Bulletin S-362.



The Brand-New, All-New Trane Reciprocating Compressor. Higher efficiency . . . smoother running . . . longer lasting . . . here's a new Trane-designed and Trane-built refrigerating unit for 10- to 50-ton jobs. See bulletin DS-361.

Choose Trane and Choose Your Own Weather! Each guest at Continental Hotel, Miami Beach, Florida, can choose his own weather because management wisely chose *UniTrane Air Conditioning* . . . complete systems like this, with *individual room weather control*, are easier than ever to design and install with Trane's bigger, better 1951 line of products.

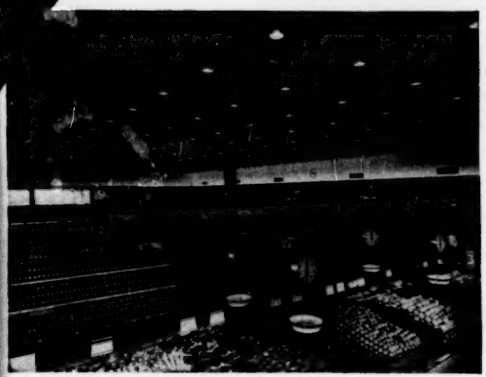
TRANE

THE TRANE COMPANY, LA CROSSE, WISCONSIN
EASTERN MFG. DIVISION • SCRANTON, PA.
TRANE COMPANY OF CANADA, LTD., TORONTO

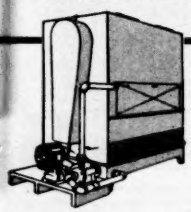
AND AIR CONDITIONING EQUIPMENT • OFFICES IN 80 CITIES

Marlo GOES TO MARKET TO ASSURE BETTER COOLING

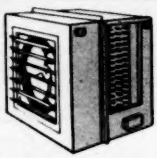
AMERICA'S MOST MODERN SUPERMARKET DEPENDS UPON MODERN MARLO EQUIPMENT



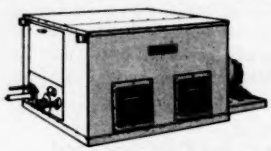
Serving the people of Greater St. Louis, Bettendorf's in Clayton, Mo., combines many striking new advances in supermarket design and service. To meet varied cooling needs in the store, one of the largest of its kind, efficient Marlo equipment was selected—



EVAPORATIVE COOLING UNITS—The 100-Ton Marlo Evaporative Condenser and 60-Ton Marlo Cooling Tower assure *maxium water savings.* Cooling Tower provides condensing water for 7 Frick and 12 Hussman compressors.



LOW TEMPERATURE UNIT—In the *frozen food cooler,* temperature is maintained at —5F by a Marlo LT-184 patented Low Temperature Unit with automatic electric defrost.



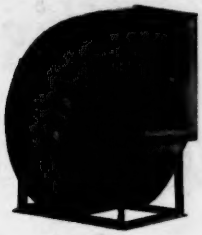
AIR CONDITIONING UNITS—The store's *gigantic shopping area* is served by efficient, compact Marlo Floor and Ceiling Type Air Conditioning Units.

MARLO HEAT TRANSFER
Since 1925

Write for information on the complete line of Marlo equipment.

AIR CONDITIONING CONTRACTOR—L. V. Fleiter Co., St. Louis
ARCHITECTS—Wischmeyer and Lorenz, St. Louis
GENERAL CONTRACTOR—Dickie Construction Co., St. Louis

COIL CO. • 6135 Manchester Rd. • St. Louis 10, Mo.

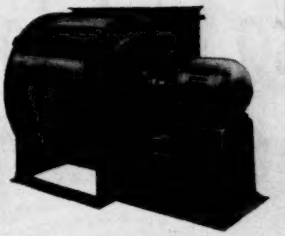


LIMIT-LOAD FANS

For large-scale ventilation. Quiet, non-overloading. Sizes up to 500,000 c.f.m. Bulletin 3675.

AXIAL FLOW FANS

For light-duty ventilation and air conditioning service. Compact, non-overloading. Bulletin 3533-C.



POWER PLANT FANS

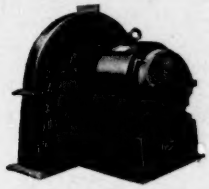
Primary, forced draft, induced draft — built for the severest service. Bulletin 3750.

BREEZO FANS

Easy-to-install wall fans. Durable and very economical. 6 sizes. Bulletin 3222-F.

TYPE "CB" PRESSURE BLOWERS

For single-stage pressure blowing up to 2¼ pounds per square inch. Bulletin 3553-A.



TYPE "CC" PRESSURE BLOWERS

In sizes for pressures up to 4 pounds and capacities up to 75,000 c.f.m. Bulletin 3553-A.

BABY CONOIDAL FANS

Compact, for portable or duct-connected service. Quiet, efficient. Bulletin 3499.

VOLUME FANS

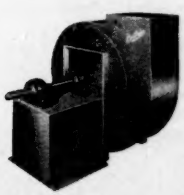
For blowing or exhausting, up to 10" s.p. 8 discharge positions. Bulletin 3615-A.

BELTED VENT SETS

Compact, "package" fans for duct or free-air delivery. Non-overloading. Bulletin 3720.

"RE" BLOWERS—EXHAUSTERS

Larger versions of "Buffalo" "E" Blowers, in sizes from 50 to 1600 c.f.m., for pressures up to 40" of water.

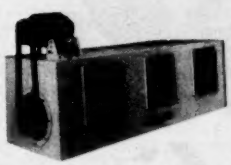


INDUSTRIAL EXHAUSTERS

With interchangeable wheels for air exhausting or materials conveying. All-welded. Bulletin 3576.

"E" BLOWERS—EXHAUSTERS

For oil or gas furnace blowing, line boosting, cleaning. Bulletin 3014-C.



SHORTBOY VENTILATING SETS

New high efficiency all-aluminum blowers with hollow shaft. Bulletin 3701.

BELT-AIR FANS

Efficient, quiet wall fans for free-air delivery up to 19,000 c.f.m. Bulletin 3222-F.

"Buffalo" BUILDS THE *RIGHT* FAN FOR THE JOB

Whether you need to ventilate a small room or an entire factory — clean tools with air or give your boiler system the most efficient mechanical draft — "Buffalo" builds the fan for the job! And whatever "Buffalo" fan you pick, you can know that its performance is backed by 73 years of "air know-how". Take a look at the fans shown here, and write us for engineering bulletins by number on any that might fit your particular application!

BUFFALO FORGE COMPANY

480 BROADWAY • BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Branch Offices in all Principal Cities

—And For PUMPS . . .

. . . you'll find a rugged precision-built "Buffalo" Centrifugal Pump of the right design, the right metal or alloy and right capacity to handle your liquid-moving job most efficiently. WRITE FOR FACTS!

BUFFALO PUMPS, INC.

480 BROADWAY • BUFFALO, NEW YORK

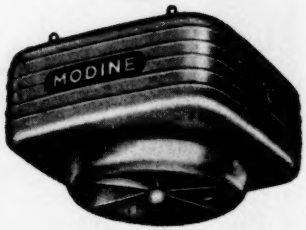
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

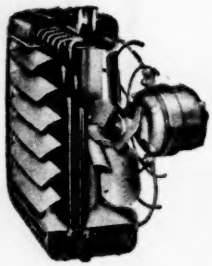
Branch Offices in all Principal Cities

It pays to look for these qualities when selecting Unit Heaters

SIGHT FOR STYLING

You'll like smart, functional Modine styling—the achievement of one of America's standout industrial designers. Modines' truly good-looking lines complement any interior.



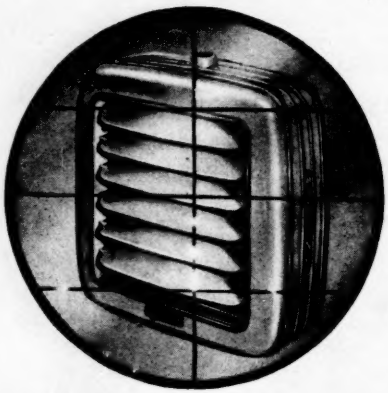


SIGHT FOR CONSTRUCTION

Smart-looking, yes... and mighty rugged, too! Modines are well-known for their long years of dependable, trouble-free service. Steam and water carrying passages are copper and copper alloy to resist corrosion. All joints are brazed. Tubes and headers are cylindrical—are brazed at the joints to withstand greater pressure. Parker-Bonderized casings are rust-resistant.

SIGHT FOR PERFORMANCE

Horizontal, Vertical or *Power Throw* . . . any Modine model gives you outstanding, year-in year-out performance. Thanks to expert engineering, Modines assure you the correct outlet air temperature and the right air velocity for uniform comfort. Economical to operate, too!



For Magnified Value . . . always select Modine Unit Heaters!

Yes, for styling, construction and performance, depend on Modines for *big value* all the way! In factories, stores, hundreds of other locations — Modine Unit Heaters excel in efficient, low-cost service. Get all the facts from your nearest Modine representative. He's listed in the classified section of your phone book. Or write direct, Modine Mfg. Co., 1511 Dekoven Ave., Racine, Wis.

Ask for Modine Unit Heater Bulletin 149A. Also available—bulletins covering special applications in commercial brooder houses, greenhouses and milk houses.

U-1092

Modine UNIT HEATERS

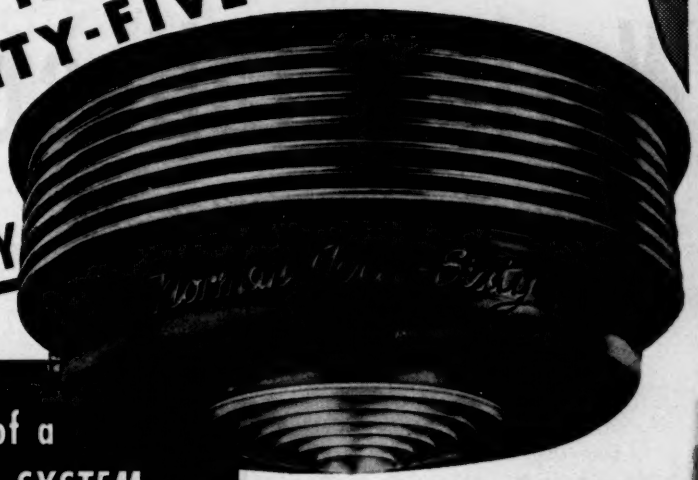
MODINE UNIT HEATERS FOR FACTORIES • STORES • GREENHOUSES • COMMERCIAL BROODER HOUSES • MANY OTHER APPLICATIONS

LUTZ.

EXTRA HEAT FLASHES

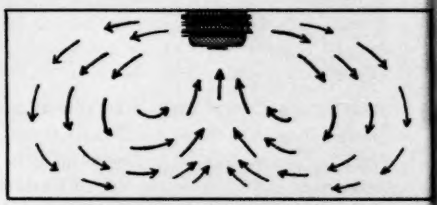
BIGGEST HEATING NEWS IN TWENTY-FIVE YEARS

NORMAN THREE-SIXTY



all the advantages of a
CENTRAL HEATING SYSTEM
in *one*
forced convection
OVERHEAD HEATER

CIRCULAR DESIGN DISTRIBUTES HEAT IN FULL 360° RADIUS

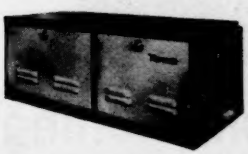


Warm air is forced horizontally in a 360° radius toward the walls . . . slowly flows down to blanket the entire floor area . . . then moves back up to the center air intake in the bottom of the heater.

Never before has overhead heating offered so many outstanding advantages. This new and better Norman principle assures constant temperatures over the entire area of diffusion from a single forced convection heater. The revolutionary circular design Norman Three-Sixty forces heat distribution horizontally in a full 360° radius. No cold spots or hot blasts. Exclusive Norman features assure simplified installation and easier servicing. Get complete facts and specifications now. *Mail coupon today.*

- ★ **NO BLAST of hot air with 360 degree heat distribution.**
- ★ **SMART STYLING Adds Modern Beauty.**
- ★ **FORCED EXHAUST of Combustion Products Eliminates Draft Divertor and Venting Problems.**
- ★ **SHALLOW DEPTH Allows Ample Head Room in Low Ceiling Applications.**
- ★ **LOW VELOCITY Impeller Assures Quiet, Comfortable Air Distribution.**

Norman Products Co., Manufacturers of the NORMAN SOUTHERNER



The Original Compact Horizontally Designed Forced Air Gas Furnace for economical space-saving installation in attic, under floor, basement, closet.

NORMAN PRODUCTS CO.
Dept. B-1
1146 Chesapeake Ave.
Columbus 12, Ohio

Please send free literature giving complete information and specifications on:

☐ Norman Three-Sixty ☐ Norman Southerner

YOUR NAME_____

FIRM NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Solved!
World's Tallest Trick

. . . in air conditioning

Every architect and engineer knows air conditioning jobs get tougher in multiple proportion to height. That's why New York's Empire State faced one of the trickiest air conditioning problems ever. It's the tallest building in the world.

Cooling off this giant involves engineering problems for which there are few precedents. Columns of refrigerated water nearly a quarter mile high—bearing down with hydrostatic pressures of more than 600 pounds per square inch—mean new kinds of equipment, new installation techniques. A plant capable of keeping these highest-in-history columns chilled and circulating —of re-processing without waste an ultimate of 5,000,000 gallons of water daily—must be designed and manufactured.

You should, of course, know the answer. It's the architect's and engineer's most frequent answer to air conditioning and refrigerating problems that can't be easily solved by precedent—

York equipment, York's seventy-five years of experience, York's seventy-five years of leadership in engineering and manufacture, have been chosen to help Empire State solve the world's tallest air conditioning job . . . and take the first step toward making selective air conditioning available to Empire State tenants where and when wanted.

WHEN YOU'RE FACED WITH ANY PROBLEM in air conditioning or refrigeration, remember York has the most complete nationwide organization of trained engineers to help you solve the initial headaches. And remember York's Certified Maintenance Plan saves your client the headaches afterwards.

YORK'S SALES POLICY IS TO WORK THROUGH YOU—to channel all contracts through the architect, engineer, contractor. Experience has shown that our knowledge, working with yours, brings best results. Check your York District Office to save time and detail on your next "tall" job. York Corporation, York, Penna.

Consulting Engineer: Edward E. Ashley
General Contractor: Starrett Brothers & Eken, Inc.
Mechanical Contractor: Almirall & Co., Inc.

The big advances come from

YORK

Headquarters for— **Refrigeration and Air Conditioning**

Low water cut-offs for hot water heating boilers was YOUR idea; not ours . . .

It's funny how you can keep walking along a beaten path, thinking you're wide awake, but actually missing something that's right in front of your face.

We were doing just that—going along the beaten path of low water cut-offs for steam boilers when we suddenly awoke to the fact that many contractors and engineers were installing low water cut-offs on hot water heating boilers . . . and for particularly sound reasons.

What were the reasons? This question was put up to our engineering department recently by a Seattle contractor and they responded with two pages of facts (available to anyone interested) but for practical purposes they might as well have said:

There are just about as many reasons for losing the water in a hot water boiler as in a steam boiler . . . loss of connected load, runaway firing, prolonged discharge of a relief valve, or just plain leakage in the system. This being the case, a water level control is just as essential to a hot water boiler as to a steam boiler.

We first recognized this when we found a number of heating engineers using our No. 150 cut-off on large hot water jobs. However, we really sat up and took notice when we found a contractor preparing to use a large number of our No. 67 Low Water Cut-offs on hot water jobs. This wouldn't do at all because the No. 67 is designed for a maximum of 20 lbs. whereas the usual maximum on hot water heating boilers is, as you know, ten pounds higher than this.

That is why we developed the No. 63 Low Water Cut-off illustrated here. The No. 150 (designed for 150 lbs. maximum) is of more expensive construction than is needed for low pressure hot water boilers and the No. 67 is not designed for the higher allowable pressures of the hot water boiler. Hence the No. 63, for pressures up to 50 lbs., designed specifically for hot water systems. Into it has gone the best of all we have learned in "Doing One Thing Well". Ask for bulletin containing complete facts and installation diagrams.

McDONNELL & MILLER, INC.
3500 N. Spaulding Ave., Chicago 18, Illinois

Note new address

Doing One Thing Well

Specifically designed for hot water heating boilers

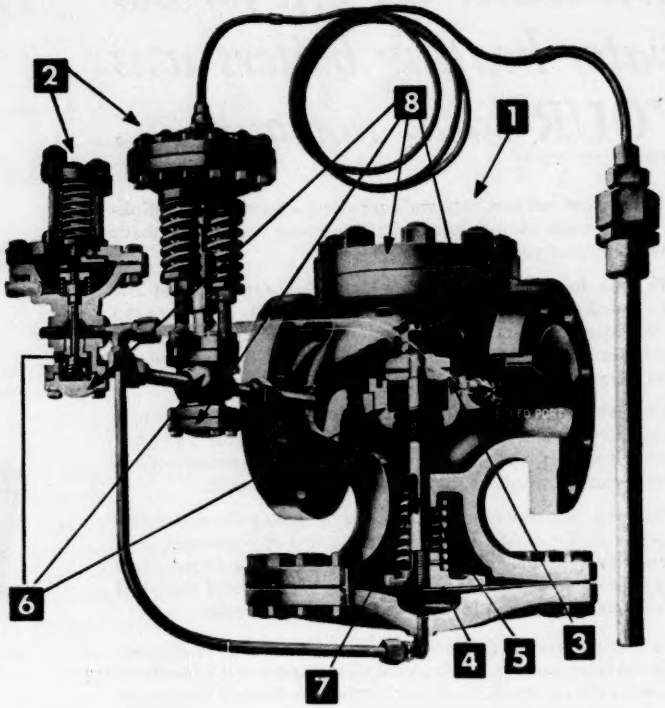
The No. 63 will dependably break the circuit to the burner whenever the water level falls below a safe level. Designed for a maximum pressure of 50 lbs., it is the ideal low water cut-off for the hot water boiler. All operating parts are isolated from the heat of the float chamber. Heavy duty bellows eliminates packing. Switch is dependable McDonnell snap-action type; A.C., ¾ hp. 110-220V.; D.C., 125 V.A. 115 V. Underwriters' approved. A typical hook up is shown above.

Boiler Water Level Controls

NOW! CUT COSTS OF PRESSURE

These SPENCE features *show you how:*

YOU SAVE MONEY with Spence Self-Operated Regulators because they function dependably and accurately year after year *without requiring extensive repairs or special attention.* This long trouble-free life means less down-time of the system, less time and money wasted on replacement of parts. Thus, you lower over-all costs and, at the same time, are assured of quality performance.



The cutaway illustration above shows why Spence Regulators . . .

REGULATE ACCURATELY

1 The single-seated *packless* main valve is actuated by a large balanced diaphragm. The construction eliminates the need for closely fitted parts which may stick or bind due to uneven expansion or foreign matter.

2 One or more sensitive pressure or temperature pilots control the main valve.

Because the Spence design minimizes friction, accurate regulation remains unaffected by changes in service conditions or length of service.

STAY ON THE JOB FOR YEARS

3 SECO Metal Seats and Discs resist wiredrawing. More than 20 years of experience with SECO Metal in thousands of installations has failed to produce one single case where SECO Metal has been cut by steam.

4 Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.

5 The spring in the Spence Regulator is out of the path of the fluid flowing through the valve. It operates at low unit stress to assure performance over an unusually long life.

REDUCE MAINTENANCE

6 The seat and disc of the main valve and pilot can be cleaned and any working part removed, without taking the main valve out of the line.

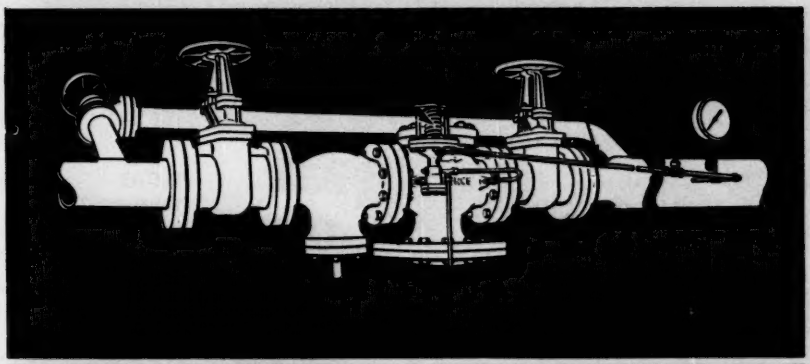
7 All main valves and most pilots are built without stuffing boxes. This packless construction eliminates much time-consuming maintenance.

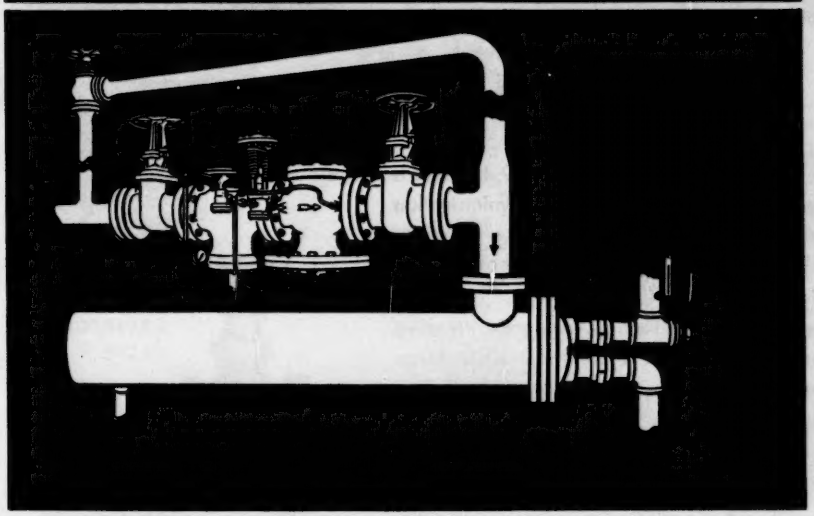
8 No dismantling is necessary to inspect the main valve disc, the pilot valve member and the SECO Metal bleedport. Special openings are provided. Inspection is easier, too, because the pilot is not an integral part of the main valve.

SPENCE ENGINEERING COMPANY, INC.

AND TEMPERATURE CONTROL

TYPICAL INSTALLATIONS





HAVE UNUSUAL VERSATILITY

9 The Spence Regulator, due to its unique design, will serve many functions and will handle all the various types of fluids under a wide range of service conditions. One of the great advantages of this Spence design is the interchangeability of all pilots on all sizes of main valves. Any main valve can be changed from a pressure to a temperature regulator or vice versa *simply by substituting one type of pilot for another.*

Spence Regulators are built in sizes from ¼" to 12" for service with air, steam, water, oil or gas. With minor adjustments, any Spence Regulator can be easily switched from one service to another.

FREE BULLETIN gives complete engineering details and selection data. It features a full color, fully illustrated description of the operating cycle of a Spence Regulator. Send for your copy of this valuable bulletin today.

9

TYPICAL PRESSURE PILOT MODIFICATIONS AVAILABLE

Type	Delivery Pressure Range, PSI	Normal Accuracy + or −
D	3-150	1 PSI
DS	1-25	½ PSI
W	0-10	¼ PSI
W7	0-3	½ OZ

PARTIAL LIST OF USERS

- The Cleveland-Cliffs Iron Company
- Tennessee Coal, Iron and Railroad Company
- The Springs Cotton Mills
- Ford Motor Company
- Cochrane Corporation
- Philadelphia Electric Company
- Pennsylvania Power & Light Company
- L. H. Gilmer Company Div. of United States Rubber Co.
- York Corporation
- Jones & Laughlin Steel Corporation
- The Duluth Steam Corporation
- Rochester Gas and Electric Corporation
- Consolidated Gas Electric Light and Power Company of Baltimore
- Phenix Natural Gas Company
- Cutter Laboratories
- National Tube Company
- The Atlantic Refining Company
- Great Lakes Steel Corporation
- Union Electric Company of Missouri
- Todd Shipyards Corporation
- Oxford Miami Paper Company
- Land O'Lakes Creameries, Inc.
- Ohio Edison Company
- General Electric Company
- R. J. Reynolds Tobacco Company

Spence

WALDEN, NEW YORK

...and the new Baltimore Airport

Architects and Engineers:
Whitman, Requardt, Greiner & Associates, Baltimore, Md.

Heating, Plumbing and Air Conditioning Contractor,
Lloyd E. Mitchell, Inc. Baltimore, Md.

is ALL-SARCO

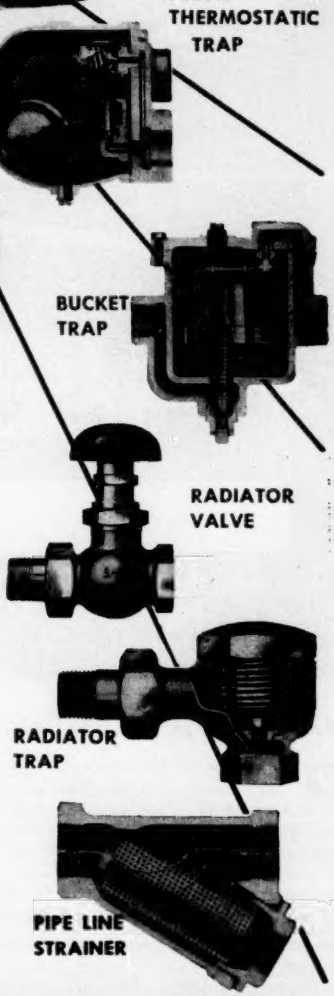
Friendship International Airport with a landing runway of 9,450 feet is the largest civilian runway on the eastern seaboard. The Administration Building alone occupies more than an acre of ground and is a combination office building, terminal and hotel, with roomettes, showers and dressing rooms for hold-over passengers.

Years of planning preceded its construction. And after mature consideration the heating engineers selected more than 1000 Sarco accessories to keep the operation reliable, satisfactory and efficient from a fuel consuming standpoint.

They decided to standardize on SARCO. Not on one type of trap —but three different types, each used in its proper place. Sarco radiator traps and valves, of course. Then various forms of the Sarco float-thermostatic trap for drips, risers and unit heaters, and Sarco bucket traps for the water heaters.

Then to insure continuous operation, Sarco pipe line strainers were placed at all important points.

FOR YOUR PLANT: You may need an entirely different selection from the many types and sizes of Sarco steam traps and temperature control. Certain it is that the Sarco Representative near you can understand your needs and suggest the combination which will give you utmost heating satisfaction for years to come at lowest heating costs.



332

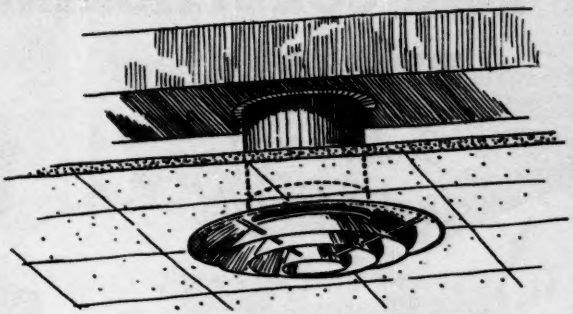
SARCO SAVES STEAM

IMPROVES PRODUCT QUALITY AND OUTPUT

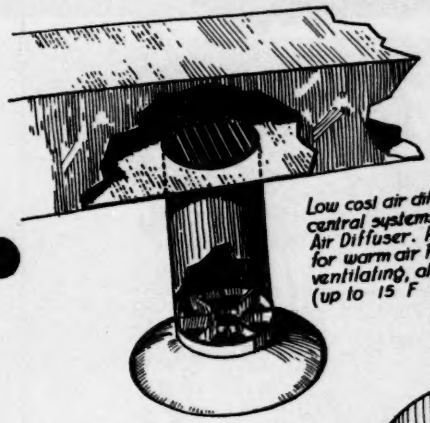
SARCO COMPANY, INC.
Represented in Principal Cities
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 8, ONTARIO

ideas for using ANEMOSTAT AIR DIFFUSERS

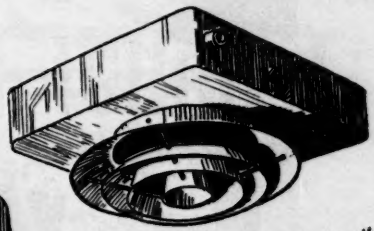
... to solve thousands of industrial heating and ventilating applications

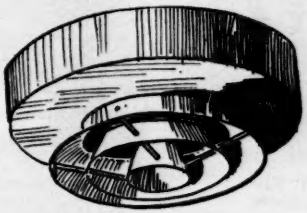


Flush ceiling mounting with duct from central system. May also be used with unit heaters located above ceiling



Low cost air diffusion from central systems with HU Anemostat Air Diffuser. Particularly suitable for warm air heating and ventilating, also limited cooling (up to 15° F Temp. Diff.)





Types HU-3 and HU-4 Anemostats greatly improve air distribution and may be combined with practically all sizes and makes of vertical discharge unit heaters.

Anemostat Air Diffusers offer unlimited design possibilities. They can be used in regular, acoustical and egg crate ceilings . . . combined with all types of lighting fixtures . . . in commercial, industrial and home applications. Anemostat Air Diffusers provide uniform diffusion throughout the entire conditioned area. They eliminate harmful drafts, stale air pockets and equalize temperature and humidity. New Selection Manual contains complete application and specification data. Write for your copy.

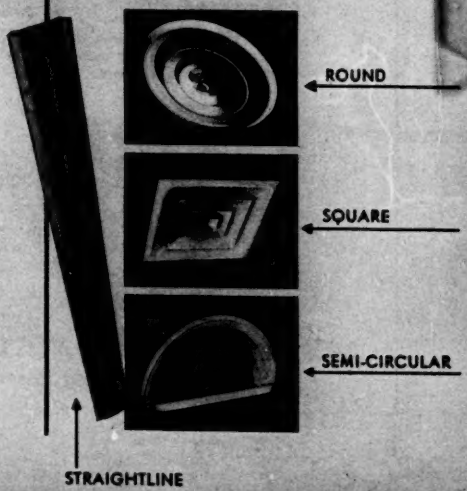
"No air conditioning system is better than its air distribution"

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA, 10 EAST 39th STREET, NEW YORK 16, N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

ANEMOSTAT offers maximum design possibilities because only Anemostat Air Diffusers come in all these shapes



"AIR CONDITIONING BUSINESS?

I was ready to give it up!" *

My end-of-the-season figures showed me I wasn't clearing a dime on our air conditioning business...

Then a Typhoon dealer I met at an air conditioning show told me about the Typhoon Profit Plan...

Are those Typhoon units rugged! Say they ought to be... Typhoon engineers have 42 years of air cooling experience behind them.

I've got to hand it to those Typhoon district sales managers – they gave my boys 100% backing...

And with the wide range of Typhoon sizes, I was able to bid on many jobs I couldn't touch before.

The first season I sold 25% more units than before—and my profits were up 40%. Brother, I'm back in the air conditioning business!

Talk to TYPHOON Now about the 5 Point Profit Plan

**A typical Typhoon case history – other success stories on request.*

TYPHOON
Air Conditioning
UNITS
1½ to 20 Tons

TYPHOON AIR CONDITIONING CO., INC.
794 Union Street, Brooklyn 15, N. Y.

Look Around...

You'll Find

AGITAIR®

Everywhere

The Only Air Diffuser
Tailor-Made
for Each Application

In buildings . . . plants . . . stores . . . offices . . . restaurants . . . banks . . . hospitals . . . hotels — you'll find AGITAIR Type R diffusers, with patented built-in diffusing vanes, providing correct air distribution . . . noiselessly, draftlessly. Only AGITAIR Type R diffusers may be assembled in a variety of patterns to provide blows in one — two — three and four directions, proportional to the area being served. Result: 100% air distribution in any shape area, from any location.

Write for Complete Data

AIR DEVICES Inc.

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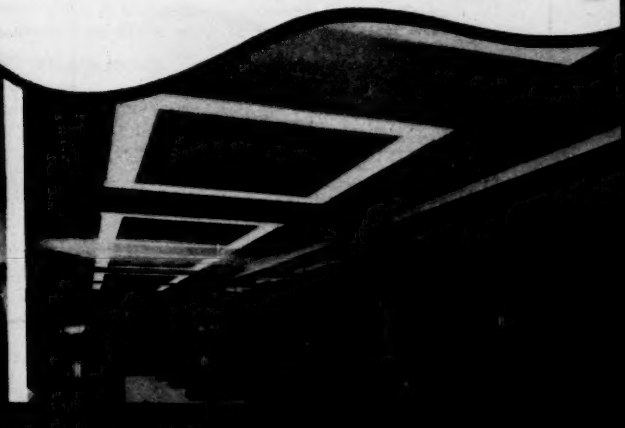
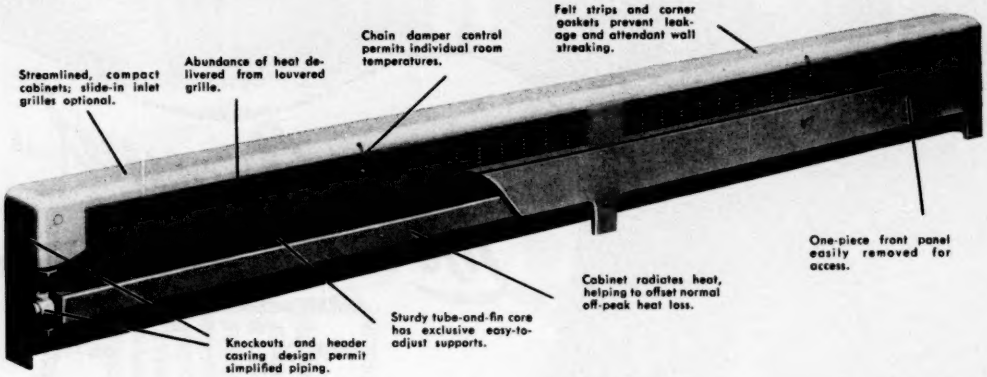
Air Diffusers • Air Filters • Roof Exhausters



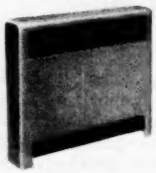
ANNOUNCING YOUNG...

Low-Level Convector-Radiators

FOR INSTALLATION BENEATH PICTURE WINDOWS


Streamlined, compact cabinets; slide-in inlet grilles optional.
Abundance of heat delivered from louvered grille.
Chain damper control permits individual room temperatures.
Felt strips and corner gaskets prevent leakage and attendant wall streaking.
One-piece front panel easily removed for access.
Cabinet radiates heat, helping to offset normal off-peak heat loss.
Sturdy tube-and-fin core has exclusive easy-to-adjust supports.
Knockouts and header casting design permit simplified piping.

OTHER STANDARD TYPES



Free Standing Type "F" —Suitable for either free-standing or semi-recessed installation.

Wall-Hung Type "S"—Sloping top grille. Wall-hung model facilitates cleaning of floors.

Partially-Recessed Type "R"—Cabinet fits into wall recess conserving valuable floor space. Type "FR," Fully Recessed Model. Designed for full utilization of room space.

Bathroom Type "B"—Compact wall-hung unit permits installation under average lavatory fixture.

Here is a Convector-radiator just 12" high, yet capable of providing a blanket of warm air for the "room with a view."

It's the Type "FL" model—the latest addition to the Young line of Convector-radiators—for use with any hot water or two-pipe steam system. Low-level cabinets are available in a wide selection of sizes, ranging from 20" to 112" in length, 4", 6", and 8" in depth, and for either free standing or semi-recessed installations.

Specify "Young" for your convector-radiator requirements. All models are tested and rated in accordance with Commercial Standards CS 140-47, as developed cooperatively by the trade and national Bureau of Standards, U. S. Department of Commerce.

Catalog No. 4150, just released, gives roughing-in dimensions, ratings, etc. Write now for your copy.

YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality

Reg. U. S. Pat. Off.

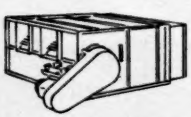
Heating, Cooling, Air Conditioning Products for Home and Industry.

YOUNG RADIATOR COMPANY

DEPT. 521-B, RACINE, WISCONSIN

Plants at Racine, Wisconsin and Mattoon, Illinois

Sales and Engineering Representatives in All Principal Cities



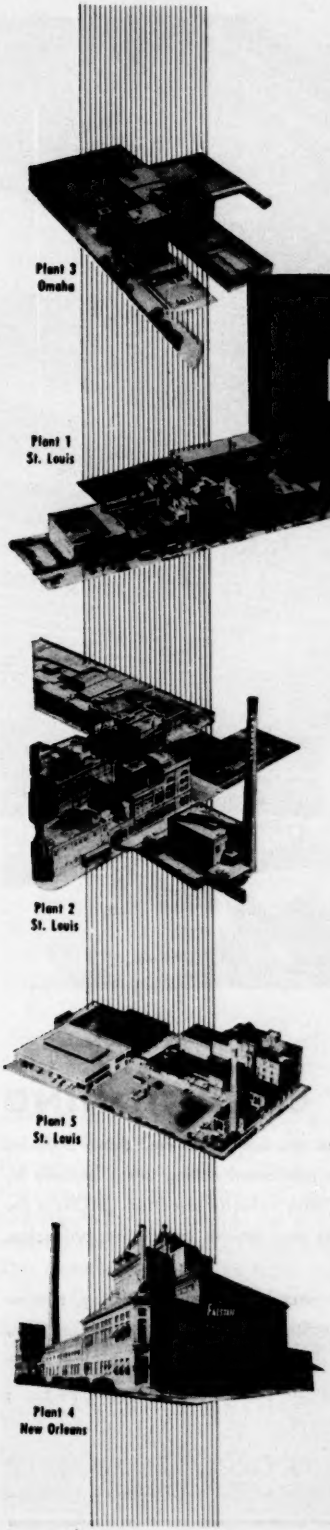
"YAC" Air Conditioners

Horizontal Unit Heaters

Cabinet Unit Heaters

Heating - Cooling Coils

"Vertiflow" Unit Heaters



At all five great plants of . . .

Falstaff Brewing Corporation...

as in buildings that set the pace in every industry . . . you'll find

Jenkins Valves

In the brewing of Premium Quality Falstaff, Yesterday and Tomorrow meet. At five great plants — in St. Louis, Omaha, and New Orleans — Falstaff Brewing Corporation combines ancient brewing skills with the most modern brewing methods.

To produce, and maintain, the same "premium quality flavor" in different breweries is no small accomplishment. Falstaff employs not only the latest in scientific knowledge but, for absolute uniformity of product, the most dependable equipment modern engineering can devise. That is why Jenkins Valves are on the pipelines in all five Falstaff plants.

Modern brewery, super-airport, or skyscraper — wherever unfaltering efficiency and long service life are "musts" in operating equipment, you'll find Jenkins Valves. They have been the choice, consistently, of leading architects, engineers and contractors for the buildings which are shaping America's skyline of Tomorrow.

For Jenkins builds extra endurance into valves — proved by low upkeep cost records in every type of service. Yet, despite this extra value, *you pay no more* for Jenkins Valves.

For new installations, for all replacements, let the Jenkins Diamond be your guide to lasting valve economy. Jenkins Bros., 100 Park Ave., New York 17; Jenkins Bros., Ltd., Montreal.

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MULTI-VENT (T. M. REG.)

Low Velocity Air Diffusi
CEILING PANELS

Multi-Vent Panel Air Diffusers completely concealed; installed in ducts above suspended acoustical ceilings.

YALE & TOWNE MFG. CO.
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The Ballinger Associates, Architects & Engineers. Turner Construction Co., General Contractor. Riggs-Distler & Co., Inc., Mechanical Contractor.

*See SWEET'S Arch. & Eng. Files or: Write for detailed literature and the name of the Multi-Vent sales engineer in your vicinity.

for COMPLAINT-FREE AIR CONDITIONING

Multi-Vent insures truly complaint-free air conditioning, because only Multi-Vent Panel Diffusers can provide perfect overall air distribution, through large perforated ceiling areas, entirely by ***pressure displacement*** — completely free from BLOW or ***high velocity injection***. BLOW is the direct source of all draft hazards and is responsible for the most serious installation, balancing, maintenance and adjustment problems.

Multi-Vent is the best buy for virtually every type of commercial or industrial building, new or old where true comfort or where uniformity and accurate control of air movement, temperature, and humidity is the primary objective.

In addition the use of Multi-Vent Panel Diffusers makes possible substantial savings in the basic air conditioning equipment, installation and maintenance costs.

MULTI-VENT DIVISION **THE PYLE-NATIONAL COMPANY**
1374 N. KOSTNER AVE., CHICAGO 51, ILL.

HOW SUPERIOR'S 4-pass design gives you . . .

Taper Tube EFFICIENCY

The long-lived efficiency of Superior Steam Generators results from fundamentals of design which are basically sound. Superior's 4-pass, down-draft design provides a minimum of 5 sq. ft. of heating surface for each unit of horsepower rating; **and every inch of that heating surface is effective.**

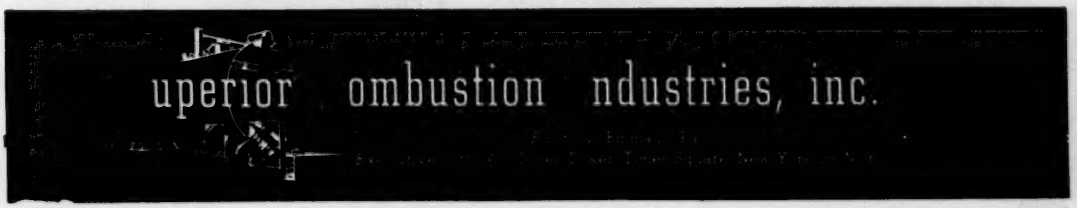
WHY 4-PASS?

Theoretically (from the standpoint of heat transfer alone) the fire passes of a perfectly designed fire tube boiler would resemble a long, very gradually tapered cone surrounded by water. The large end would be sized in ratio to the volume and speed of the combustion gases so that the gases would be crowded into the tube and thus "scrub" the walls of the tube, forcing contact between fire and tube surface. As the gases give up their heat to the surrounding water (by transfer through the tube) the gases shrink in volume. The gradual taper of the tube compensates for this shrinkage, maintaining the scrubbing action which promotes efficient heat transfer.

Such a fire tube is impractical; but Superior's 4-pass design achieves the same effect. Its 4 passes are so designed that each successive pass has a lesser number of tubes (and hence a smaller area in cross section) for the passage of combustion gases. This is, in effect, **taper-tube** performance which results in the maximum practical efficiency of heat transfer . . . performance which makes it possible for Superior to guarantee more than 80% thermal efficiency **under field operating conditions.**

Superior Steam Generators are completely factory assembled, backed by undivided responsibility. Burn gas or oil, or both. Manufactured in 18 sizes from 20 to 600 b.h.p. for pressures up 250 p.s.i. or for hot water.

Write today for the details in Catalog 319.



A UNITAIRE CONDITIONER

TO MEET ALL YOUR REQUIREMENTS . . .

. . . for increased worker efficiency or customer comfort.

When you buy or specify the Westinghouse UNITAIRE, it will be:

● **SIZED TO FIT YOUR NEEDS.** The UNITAIRE is available in 2-, 3-, 5- and 7½ horsepower capacities.

● **DEPENDABLE.** You are assured of undivided responsibility for all major parts. The Westinghouse Hermetically-Sealed Compressor has an unequalled performance record in thousands of successful installations.

● **ECONOMICAL.** The elimination of belts, pulleys and shaft seals in the Hermetically-Sealed Compressor design means less maintenance and a longer, trouble-free service life.

● **ADAPTABLE.** The UNITAIRE can be installed alone, in multiples, or with duct systems. The addition of a heating coil provides year 'round air conditioning.

● **EASY TO INSTALL.** All sizes fit through a standard door, and require only water, electrical and drain connections before they are ready to operate.

● **COMPACT.** The largest UNITAIRE needs only a little over 8 square feet of floor space, can be fitted into recessed areas.

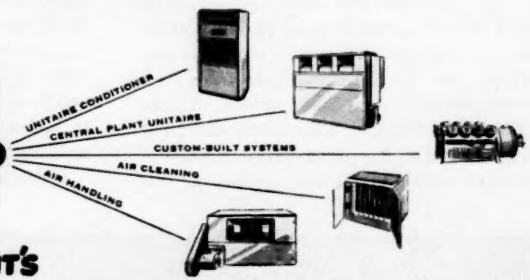
● **QUIET.** The UNITAIRE does not rise above the noise level of an ordinary store or office, and will permit you to shut off outside disturbances by closing doors and windows.

● **ATTRACTIVE.** Modern styling, clean lines and a two-toned gray finish make the UNITAIRE the smartest-looking unit on the market today.

For complete details, call the Westinghouse Air Conditioning Distributor listed in your classified telephone directory, or write Westinghouse Electric Corp., Air Conditioning Division, Hyde Park, Boston 36, Mass.

PUTTING *Air* TO WORK

Only Westinghouse can offer you a *complete* line of air conditioning, air handling and air cleaning equipment.



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Westinghouse

J-80224

KENOSHA Youth foundation
720-59th PLACE—PHONE 4104
KENOSHA, WIS.

Mr. G. A. Tiegs
Manager, Service Sales Department
Detroit Stoker Company
Monroe, Michigan

Dear Sir:

Replying to your letter of October 18, with reference to our order No. 1058, we thank you for your interest in calling our attention to your new type Hi-tuyere.

We are ordering enough supplies to put our three stokers in tip top condition and to have a few parts on hand for emergencies. Our stokers are now over 20 years old. One of these days we will probably want to replace them with more modern stokers. At that time we will be writing to you because we are 1,000% sold on Detroit Stokers from the standpoint of efficiency of operation and low maintenance cost.

Sincerely yours,

Frank A. Thompson

Frank A. Thompson, Bus. Mgr.

P. S. We want to thank you for your good service over the past twenty years, even during the war period when many firms more or less forgot their pre-war customers.

Detroit LoStoker for "firebox application". Also available for brickset boilers.

SINCE 1898

The enthusiasm expressed in this letter is typical of that of thousands of *Detroit Stoker* users.

Detroit Stokers are built better, last longer with less maintenance and save more fuel.

This installation consists of three Detroit LoStokers applied to Kewanee Boilers, placed in operation in 1930.

Detroit LoStoker, now available with *Detroit Adjustable Coal Feed* is a Compact-Single Retort-Mechanically-Driven-Plunger Feed-Side Cleaning Stoker. Coal feed and air supply may be controlled automatically as well as manually. New type Hi-Tuyeres supply more air, reduce coking tendency. Lower combustible in the ash results in higher thermal efficiency.

Write for Bulletin.

There is a Type and Size of Detroit Stoker for Every Industrial or Power Need

DETROIT STOKER COMPANY

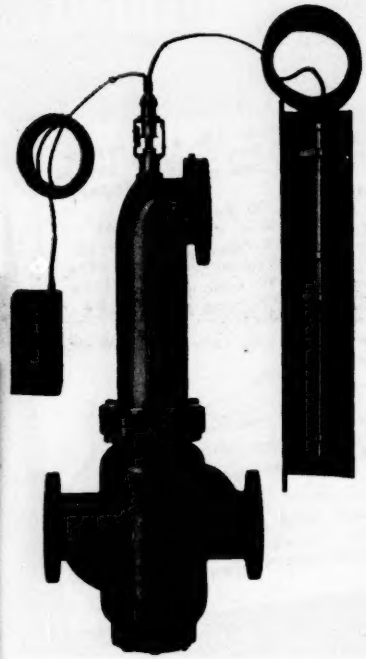
General Motors Building—Detroit 2, Michigan

District Offices in Principal Cities • Works at Monroe, Michigan

It's Here!

THE IMPROVED MODULATING CONTROL for Hot Water and Radiant HEATING SYSTEMS....

a good product made better



Sarcotherm engineers are constantly searching for a better product.

While utmost simplicity is still the dominant design principle, the new models now available show many important improvements and refinements.

Double Seated Valves are now used in the larger sizes, greatly increasing valve capacity and permitting smaller valves being used on a given size job. *Convenient manual adjustment* features are now provided in a variety of combinations. *Program control systems* are available to meet any specification.

Easy Installation. New body construction simplifies piping and allows for easy servicing.

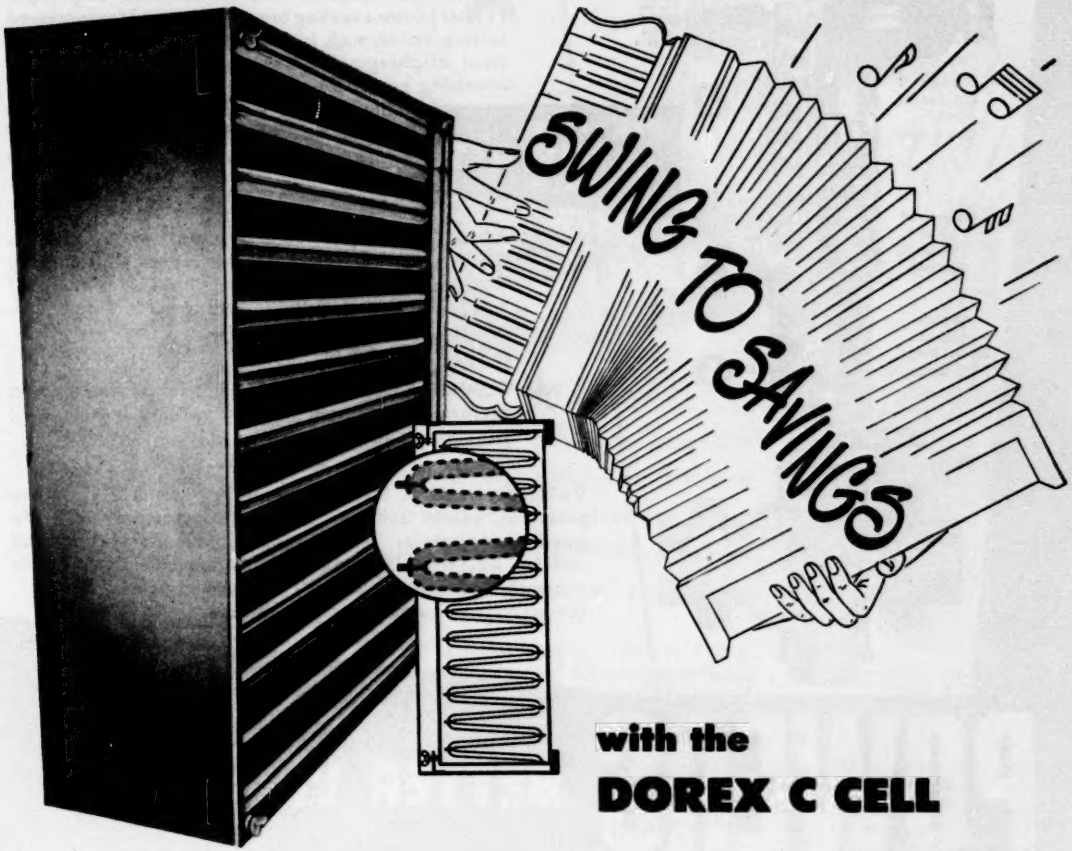
Hundreds of successful installations testify to the efficiency of this simple system. Our Engineering Department will be glad to recommend a suitable control system for your particular job.

Ask for new Bulletin ST-501 describing latest improvements.

19

Sarcotherm

SARCOTHERM CONTROLS, INC. • Empire State Bldg. • NEW YORK 1, N. Y.



with the DOREX C CELL

Accordion pleating plays a big part in keeping efficiency up, costs down. When you install Dorex Type C Air Recovery Cells in air conditioning systems and units, the most effective air purifier known—*activated* carbon—is put to work in the most effective way. Accordion-pleated beds expose maximum surface area.

This special Dorex *activated* carbon extracts all gaseous and odorous impurities from the air that passes through it—makes stale air completely fresh and re-usable. This means that the amount of new air that has to be taken in can be reduced by as much as two-thirds. *And the cost of Dorex Air Recovery is only one-fourth the cost of conditioning an equivalent amount of outside air!*

More than 6,000 users—leaders in business everywhere—now use Dorex Air Recovery. Their savings in capital expenditure for air conditioning equipment have been great; and they continue to save millions annually in operating costs. Architects, engineers and contractors have been recommending Dorex Air Recovery for more than 20 years.

Have all the facts about Dorex Air Recovery on file. Mail the coupon today.

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Air Recovery

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Danbury, Connecticu.

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TRADE MARK "DOREX" REG. U. S. PAT. OFF.

W. B. CONNOR ENGINEERING CORP.
Dept. B-12, Danbury, Connecticut

Please send me, without obligation, full information on Dorex Air Recovery.

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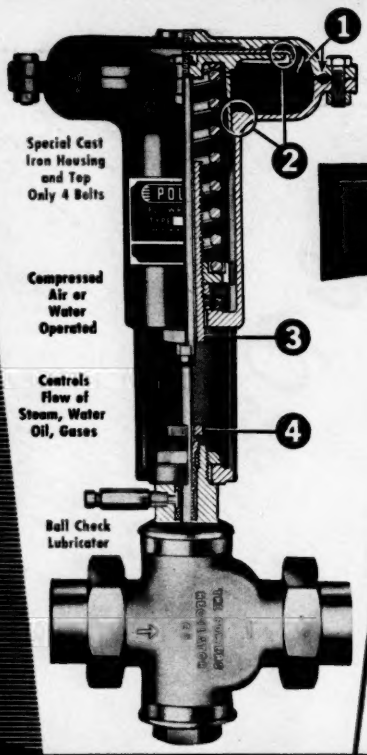
Position.....

Company.....

Street.....

City.....**Zone**.....**State**.....



POWERS **LOWRITE** VALVE

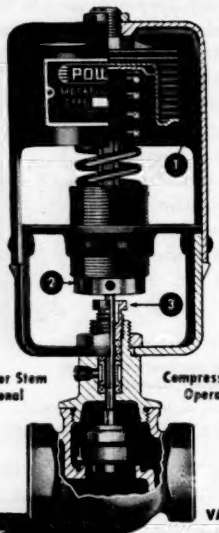
VE TOP—Durable moulded neoprene diaphragm (1) has positive sealing bead which provides increased sealing action with increasing control pressure. Efficient diaphragm form insures ample and constant operating power thru full travel. Piston Plate Assembly (2) has a free floating thrust plate which absorbs side thrust. Closely guided piston plate maintains stem in accurate alignment.

ADJUSTING SCREW—Ball bearing non-rising type. Easily accessible, 180° turning radius with starting pressure adjustable from 0 to 17 psi. Has enclosed rust proofed steel spring for full travel in 5 or 10 psi. control pressure change.

BONNET ASSEMBLY—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

VARIETY of VALVE BODIES — Sizes ½" thru 8" — For line pressures below 250 psi. Rugged construction to withstand piping strains. Single seat or double seat, bronze and stainless steel trim. Double unions and flanged ends. Available normally open (direct acting) or normally closed (reverse acting) and 3-way type valves.

POWERS BETTER Valve Tops



POWERS **ETAFLOW** VALVE

VALVE SIZES— ½" thru 2"

Bronze bodies, screwed ends. Rugged construction to withstand piping strains.

POWERS *Metaflow Valves* are small, sturdy, light-weight, reasonably priced, suitable for many control applications where the pressure differential does not exceed 75 lbs. per square inch.

1. **HOUSING**—High strength aluminum alloy. Hydraulically formed long life brass bellows provides smooth and powerful stroke.

2. **ADJUSTING SCREW**—Brass with rust proofed steel spring having 15 lbs. adjustment range to give proper sequence operation where required.

3. **BONNET ASSEMBLY**—Polished stainless steel stem in preformed lubricated metallic packing insures long life and low hysteresis.

TRIM—Composition disc with brass integral seat and self-aligning disc holder. Available normally open (direct acting) or normally closed (reverse acting), and 3-way.

METAFLOW NO-PAK VALVES prevent leakage of inflammable or harmful liquids or gases and provide vacuum protection. Are suitable for use with Freon, oil, gasoline, non-corrosive gases, hot or cold water and low pressure steam.

Phone or Write Nearest Office for Prices

THE POWERS REGULATOR CO.

OFFICES IN OVER 50 CITIES • See Your Phone Book

CHICAGO 14, ILL., 2718 Greenview Ave. • **NEW YORK 17, N.Y.,** 231 E. 46th St.
LOS ANGELES 5, CAL., 1808 West 8th St. • **TORONTO, ONT.,** 195 Spadina Ave.
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OVER 58 YEARS OF PNEUMATIC TEMPERATURE CONTROL

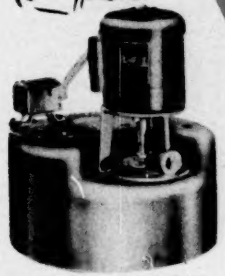
(FM3)

COMPACT • YET EFFICIENT

ALIKE IN PERFORMANCE
. . . BUT DIFFERENT IN PURPOSE

BUILT FOR A SPECIFIC USE

PEAK PERFORMANCE

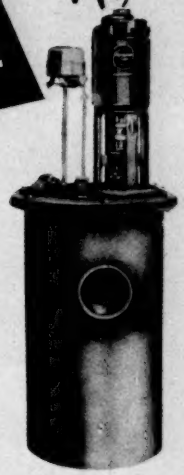


Type "CV" VERTICAL PUMP for limited space installation, has capacities ranging from 500 to 10,000 sq. ft. E.D.R. and pressures of 10-20 pounds.

Designed to conform with specific needs — the Skidmore line includes: Condensate pumps for below level returns, vertical pumps where space is limited and capacity requirements are small. Vacuum or turbine type pumps where best suited to conditions.

Day in and day out, you can depend on Skidmore heating pumps for economical operation with PEAK PERFORMANCE — under all types of conditions.

Other advantages in a Skidmore Pump is the experience of sound engineering, backed by over a quarter of a century in pump manufacturing . . . plus the fact that each type of Skidmore Pump is designed to suit a specific purpose and installation. That is why you are assured of PEAK PERFORMANCE when a Skidmore Pump is specified.



Type "UV" PUMP DESIGNED FOR BELOW LEVEL RETURNS —Capacities ranging from 2,000 to 40,000 E.D.R.

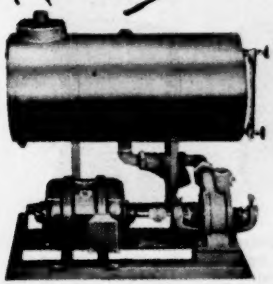
Write today for complete engineering data and specifications on any one of these, or information on the complete line of Skidmore Heating Pumps. All are efficient and economical to maintain.

ALWAYS DEPENDABLE

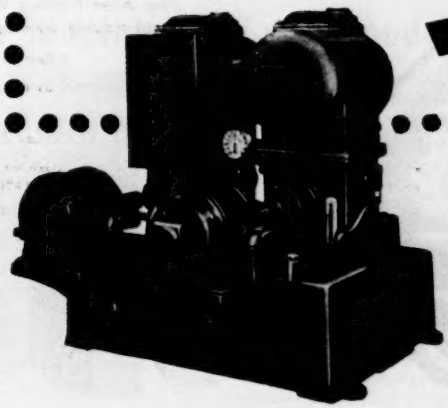
SKIDMORE PUMPS

ST. JOSEPH, MICHIGAN

ECONOMICAL TO OPERATE

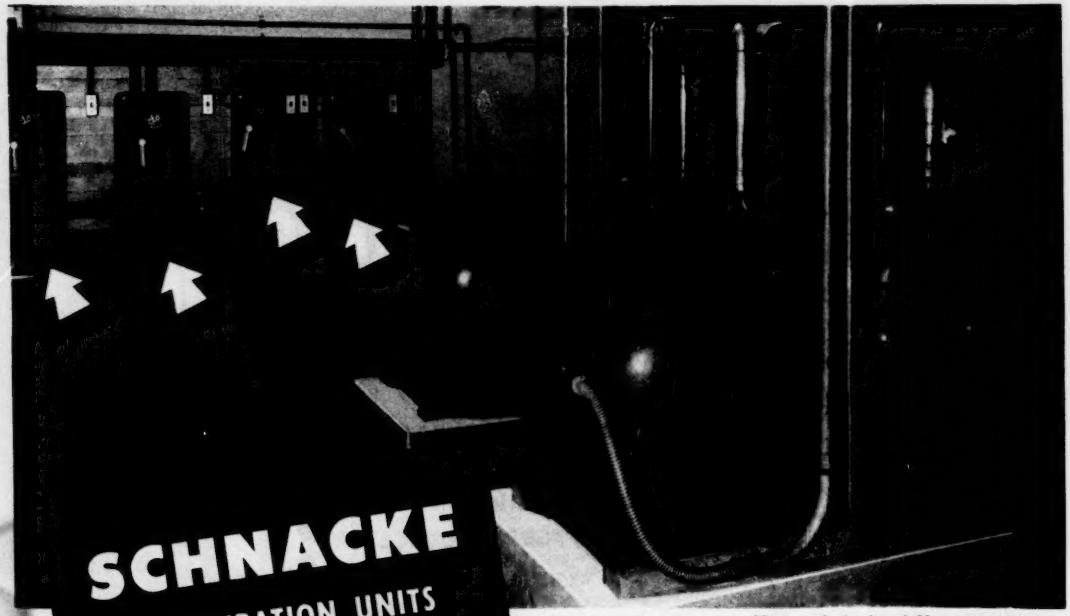


Type "TM" HIGH Pressure Turbine PUMP. Pressures up to 150 pounds, and boilers up to 250 H. P.



DUPLEX VACUUM PUMP—Made in single and duplex units with ratings of 5,000 to 100,000 sq. ft. E.D.R.

Type "HS" Pump — Capacities of 1,000 to 65,000 sq. ft. E.D.R. and discharge pressure from 10 to 75 pounds.



SCHNACKE

REFRIGERATION UNITS

equipped with

ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

Two Schnacke compressors, 30-ton main load and 20-ton stand-by unit, installed in the building of Interstate Finance Corporation. These compressors are equipped with Allen-Bradley combination starters.

Why are Allen-Bradley starters so popular for refrigeration and air-conditioning service? . . . because they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley patented silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after long service.

The Allen-Bradley trademark stands for millions of trouble free operations.

Allen-Bradley Co.

1330 S. Second Street, Milwaukee 4, Wisconsin.

A-B Quality

TYPICAL REFRIGERATION CONTROLS

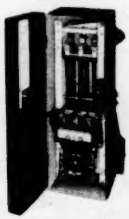
AUTOMATIC STARTER

Allen-Bradley Bulletin 709 solenoid starter.

COMBINATION STARTER

A-B Bulletin 712 disconnect switch type combination starter.

VELVET SMOOTH STARTER



A-B Bulletin 640 manual resistance type starter.

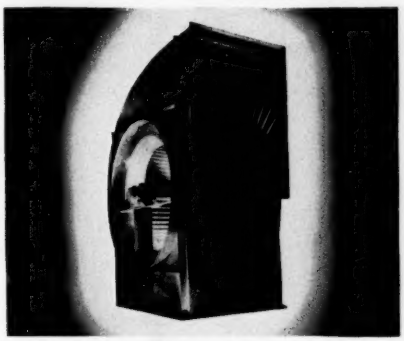
ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

American Blower—a time-honored name in air handling

All air handling equipment is not alike. There's a vast difference in quality, design, quietness, operating costs and efficiency. Look before you buy and you'll buy American Blower products—the accepted quality standard, and proved in test after test by buyers.

In Houston, as in other cities, American Blower Air Handling Products have been serving commerce, industry and public utilities for over half a century. For air handling data in the Houston area, call American Blower—Preston 6171. In other areas, consult your phone book.

Product of the month



American Blower Series 81 Sirocco Fan

Standard of the World

Since 1903, thousands upon thousands of Sirocco Fans have been installed throughout the world—in mechanical draft and industrial applications, in heating, drying, ventilating, air conditioning, fume removal and processing systems.

This unparalleled record in the field is due in part to these facts:

- The Sirocco Fan operates at lower speed, delivers more air per revolution, than any other type fan.
- For a given duty, the Sirocco Fan occupies the minimum amount of space.
- Ratings are Certified in accordance with the Standard Test Code as adopted jointly by the NAFM and ASH&VE.

For data on how the Sirocco Fan can best be applied to your business, consult the nearest American Blower Branch Office.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

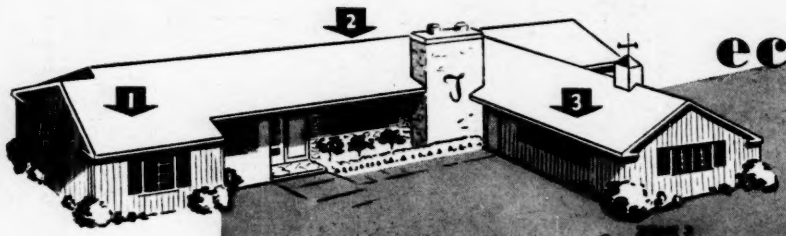
Division of American Radiator & Standard Sanitary Corporation

YOUR BEST BUY AMERICAN BLOWER AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN STANDARD · AMERICAN BLOWER · FULLER HEATS · DETROIT LUBRICATOR · KEWANEE BOILERS · ROSS HEATER · TONAWANDA IRON

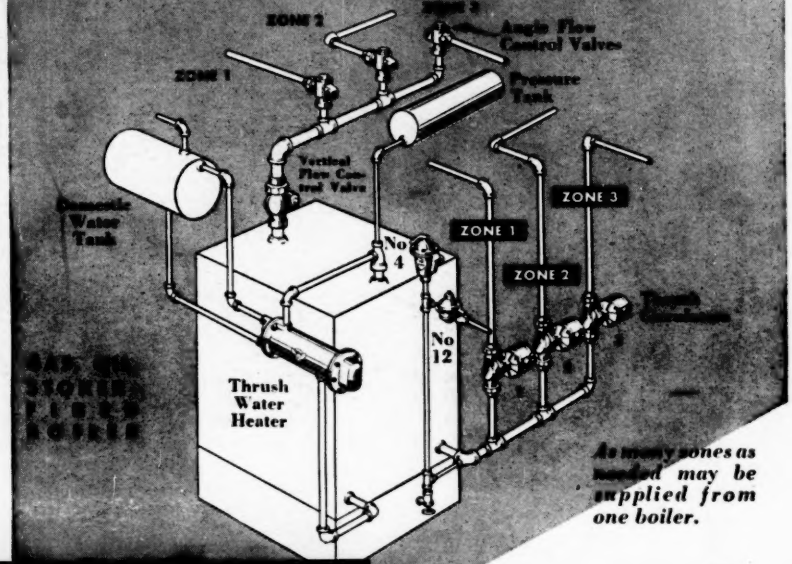
ZONED FOR COMFORT and economy!



ZONE 1—*Kitchen, Utility Room, and Servants' Quarters.*

ZONE 2—*Living Room, Den, Dining Room, and Game Room.*

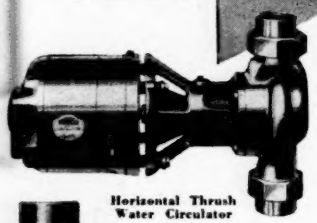
ZONE 3—*Bedroom Wing.*



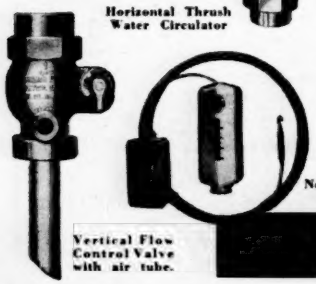
As many zones as needed may be supplied from one boiler.

THRUSH forced circulating

FLOW CONTROL HOT WATER HEAT



Horizontal Thrush Water Circulator



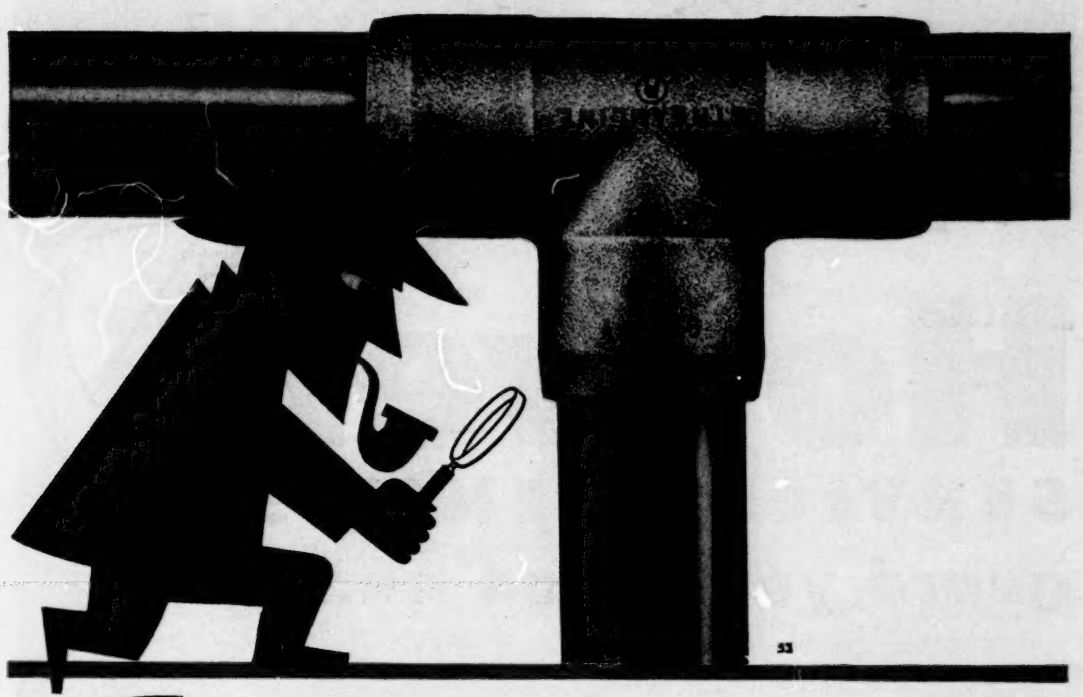
Vertical Flow Control Valve with air tube.

No. 201 Radiant Heat Control

ANY HOT WATER heating plant may be zoned easily and inexpensively with Thrush Flow Control System, to supply as many zones as are needed from a single boiler. These zones may be in the same house or in adjacent buildings, often greatly reducing equipment cost because the one boiler replaces many. Only a Circulator, with Relay Transformer, Flow Control Valve, and a Radiant Heat Control are added for each additional zone . . . simple units which give dependable and individual comfort control in each zone. Thrush Water Heater eliminates the need for separate domestic water supply as the same heating boiler automatically provides plenty of hot water for kitchen, laundry and bath summer or winter. Ask your wholesaler today for more information or write Dept. D-2 for bulletin on Zoned Heat.

H. A. THRUSH and CO.
PERU . . . . . INDIANA

solved: the case of the cost-minded customer



Streamline COPPER TUBE AND SOLDER TYPE FITTINGS

COST LESS TO INSTALL — COST LESS IN THE LONG RUN

The mystery of how to sell a cost-minded customer an all-copper supply and drainage system is neatly solved — with STREAMLINE products. For he can easily be shown the savings in installation time and the value of extra years of service of a STREAMLINE copper installation as compared to a rustable ferrous system.

The time required for roughing-in is cut down — because the uniform depth of STREAMLINE solder joints makes it easy to compute the exact length of tubing needed. The time required for handling is much less because copper tubing is approximately one-third the weight of iron pipe of the same length and size. (Being threadless, copper tube walls need be only one-third as thick.) Installation time is further decreased because no heavy, bulky pipe vise or stock and die are needed. For drainage and industrial piping, time is also saved because STREAMLINE tube sizes, even up to 10", are produced in 20 ft. lengths. A STREAMLINE installation not only reduces total job cost to the customer — it also increases the number of jobs a contractor can handle per month.

The extra years of service that any customer will get in a STREAMLINE installation is guaranteed by two facts: (1) It is all copper which cannot rust and (2) it is a snug-fitting, tightly joined system that tests leak-proof on the first try and won't develop leaks later. The years of pioneering, development, engineering and manufacturing experience of the Mueller Brass Co. guarantee an installation that is permanent and trouble-free.

See your jobber for further information or write for Catalog S-350 and W-250 describing the complete line of cast supply and drainage fittings and the complete line of wrought fittings through 4".

MUELLER BRASS CO. STREAMLINE PRODUCTS

MUELLER BRASS CO., PORT HURON 2, MICHIGAN

at the other end of your telephone . . .

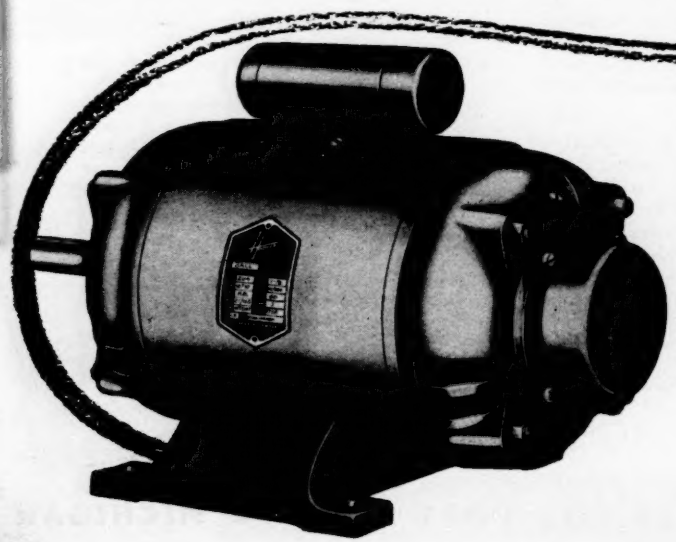
Hoover®

SERVICE AGENCIES guard your good name

Your reputation depends, more than anything else, on the performance of the products you sell. Which is why whenever you sell or install a motor or a replacement motor for a ventilating fan, oil burner, pump, home workshop, or, in fact, any purpose at all, it's mighty wise to make it a *HOOVER* Motor!

Hoover Motors are famous for reliability . . . for long, quiet, dependable service. And if there ever *IS* trouble—as there sometimes is in *ANY* motor—there's a Hoover Service Agency near at hand to restore the motor to operation in a jiffy!

Service like that guards *YOUR* good name at the same time it guards the good name of Hoover. Worth considering, don't you think? Worth selling Hoover!

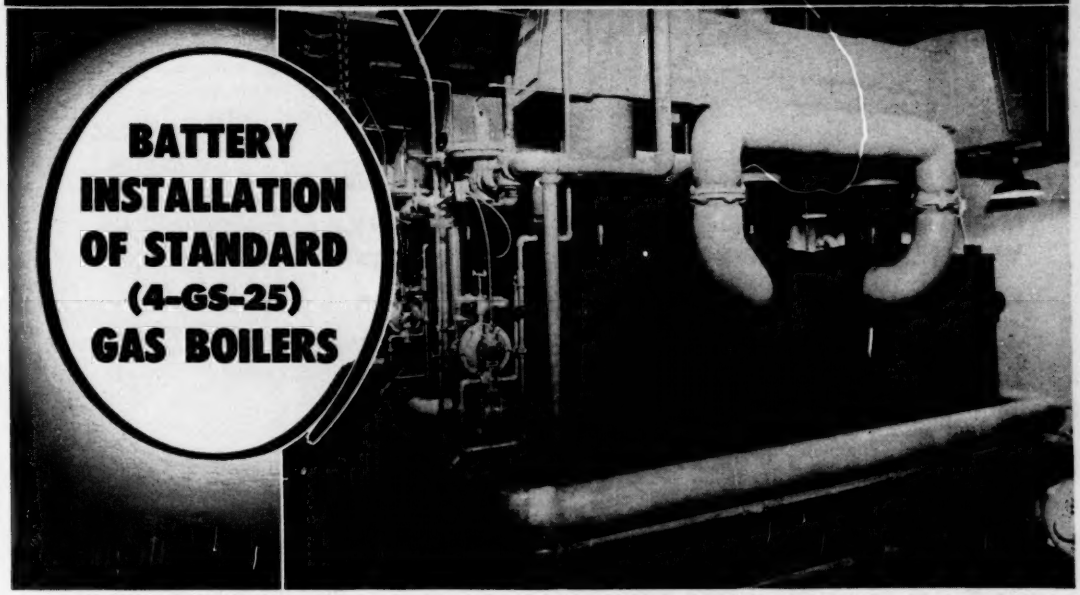


Hoover Motors for every need. General-purpose Hoover Motors come in 3 basic types: CAPACITOR-START MOTORS (¼ through 3 HP) for hard-to-start, continuous-duty applications; SPLIT-PHASE MOTORS (¼ and ⅓ HP) for easy-to-start, quick-to-accelerate applications; and POLYPHASE MOTORS (¼ through 5 HP) for use where three-phase supply lines are available. Also there are Hoover Motors designed especially for pumps, oil burners, fans and blowers. Write for details.

THE HOOVER COMPANY
Kingston-Conley Division
68 Brook Avenue
North Plainfield, New Jersey

AMERICAN-Standard

First in heating...first in plumbing



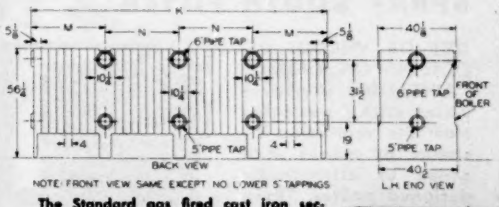
BATTERY INSTALLATION OF STANDARD (4-GS-25) GAS BOILERS

STANDARD GAS BOILERS continue to be the choice of architects, engineers and management for important installations. The battery of three 4-GS-25's shown above is in one of California's newest and busiest office buildings. The comfort and health of its occupants demand a heating system that will provide a dependable supply of warmth throughout every foot of this big building . . . and do it with a minimum operating and maintenance cost.

Standard Gas Boilers come in a wide range of sizes to provide effortless heating in larger homes, apartments, office buildings, hospitals and various commercial and industrial buildings. They can be used in battery installations in larger buildings to provide an extremely flexible heat source through the operation of one or more units, thus giving greatly increased economy during mild weather, as well as perfect comfort in the coldest weather.

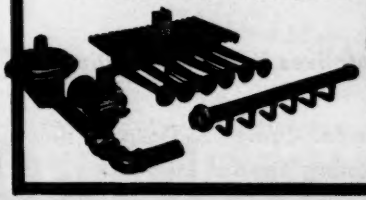
Standard Boilers and other top quality heating equipment by American-Standard are sold through selected wholesale distributors to heating and plumbing contractors. **American Radiator & Standard Sanitary Corporation,** P. O. Box 1226, Pittsburgh 30, Pa.

An important feature of larger Standard Boilers is the number of flow tappings provided. For example, type 4-GS-25 has six 6", and type 4-GS-33 (section assembly of which is diagrammed below) has eight 6" flow tappings.



NOTE: FRONT VIEW SAME EXCEPT NO LOWER 5" TAPPINGS

The Standard gas fired cast iron sectional boiler is precision-machined to facilitate quick and easy assembly. Individual sections and parts will pass through boiler room doors without difficulty. For time and labor saving installation, controls, valves and control piping are factory-assembled as far as possible.



LOOK FOR THIS MARK OF MERIT

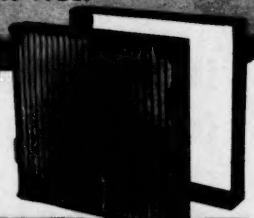
Serving home and industry

STAYNEW
PANEL FILTERS

Dry-Type * Viscous-Type

designed for a broad range of prices and applications

Simple, efficient designs and rugged construction are featured. Most types provide for cell and frame assemblies, with heavy, serviceable handles and powerful cam-type locking latches. 18-gauge steel is used throughout. Supporting frames are so designed and drilled that they can be riveted together to form a flat bank. By the addition of angles, a series of "V's" can be formed. All models typify the high efficiency and low maintenance cost for which Staynew Filters have been famous since 1920.



MODEL PVG VENTILATION FILTER . . .

Cross Section of Medium

• A low-cost, permanent, washable type filter. Designed for maximum use of medium with minimum of weight. Exclusive Staynew "RL" steel medium causes rapid changes in air direction and holds heavier particles. Finer particles are held by corrugated screen cloth and, as a final stage, layers of fine woven copper mesh. 2" and 4" units available.

MODEL WKE VENTILATION FILTER . . .

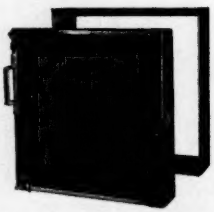
Easy to clean by vacuum

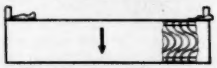
Filtering medium replaceable at low cost

Staynew Vacuum Cleaning Nozzle

Especially designed for heavy duty industrial applications. "V" construction provides large filtering area in small space. Wide variety of media available. Cleaning simple and easy with Staynew Saddle-type Vacuum Cleaning Nozzle. 2" and 4" deep units available. Fire Underwriters Class I Approved when used with B-G Medium.

MODEL SPB SPRAY BOOTH FILTER . . .

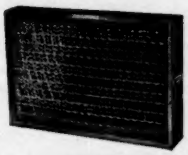


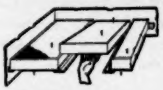


Cross Section of Medium

DRY OR VISCOUS DEPENDING ON KIND OF PAINT USED. Removes paint spray particles from the ventilation air stream by means of a series of scientifically designed baffles. These baffles cause rapid changes in direction of air-flow and consequent impingement of particles, which collect and drain to the bottom of the unit.

NEW! MODEL PVR KITCHEN RANGE FILTER





Solves the problem of grease collection in exhaust hoods over ranges, steam tables or cookers. Eliminates fire hazard and odorous, unsanitary conditions. Exclusive Staynew "RL" steel filtering medium. Available in 3" deep units. *Lowest cost high grade range filter.*

Panels easily removed for cleaning in hot, soapy water. Automatic dishwashing machine ideal for this purpose.

Representatives in Principal Cities

★

Write for Complete Data, Mentioning Special Interests

DOLLINGER PROTECTION STAYNEW FILTERS

DOLLINGER CORPORATION, 15 Centre Pk., Rochester 3, N. Y.

the JOY
AXIVANE® FAN
Mounts Right in the Air Duct—
Saves space, installation costs, gives you quieter, more efficient ventilation!
Consult a Joy Engineer
JOY MANUFACTURING COMPANY
GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.
IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED

An ILLINOIS Automatic Type E Cycling Flow Control System

FORSTNER CHAIN CORPORATION BUILDING

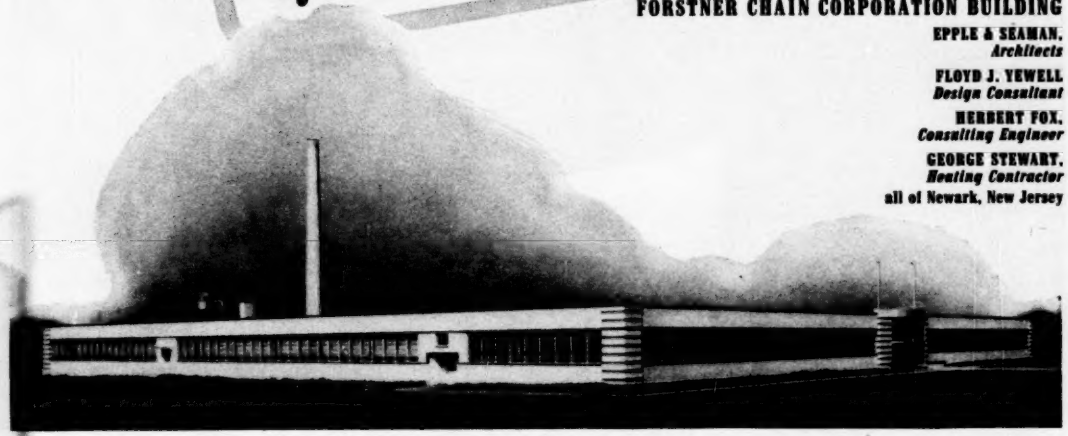
EPPLE & SEAMAN, *Architects*

FLOYD J. YEWELL *Design Consultant*

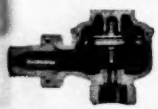
HERBERT FOX, *Consulting Engineer*

GEORGE STEWART, *Heating Contractor*

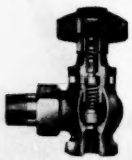
all of Newark, New Jersey



Type E Motorized Control Valve



Series G Thermo Trap



Series 48 Supply Valve

IN THIS MODERN FACTORY of the Forstner Chain Corporation, an ILLINOIS Type E Zone Control System assures fuel economy, heating comfort and the convenience of fully automatic operation.

The boiler plant, oil fired, is in a separate building and unattended except for periodic inspection. Boiler pressure at 14 pounds is used for process work and unit heaters serving the loading platforms. An ILLINOIS Pressure Regulating Valve reduces this to 4 pounds for convectors used to heat the remainder of the building, which is divided into five zones... one office and four manufacturing. Each zone is independently controlled by its own motor valve and outdoor-indoor-radiator temperature controller, with provision for automatic night, week-end and holiday set-back.

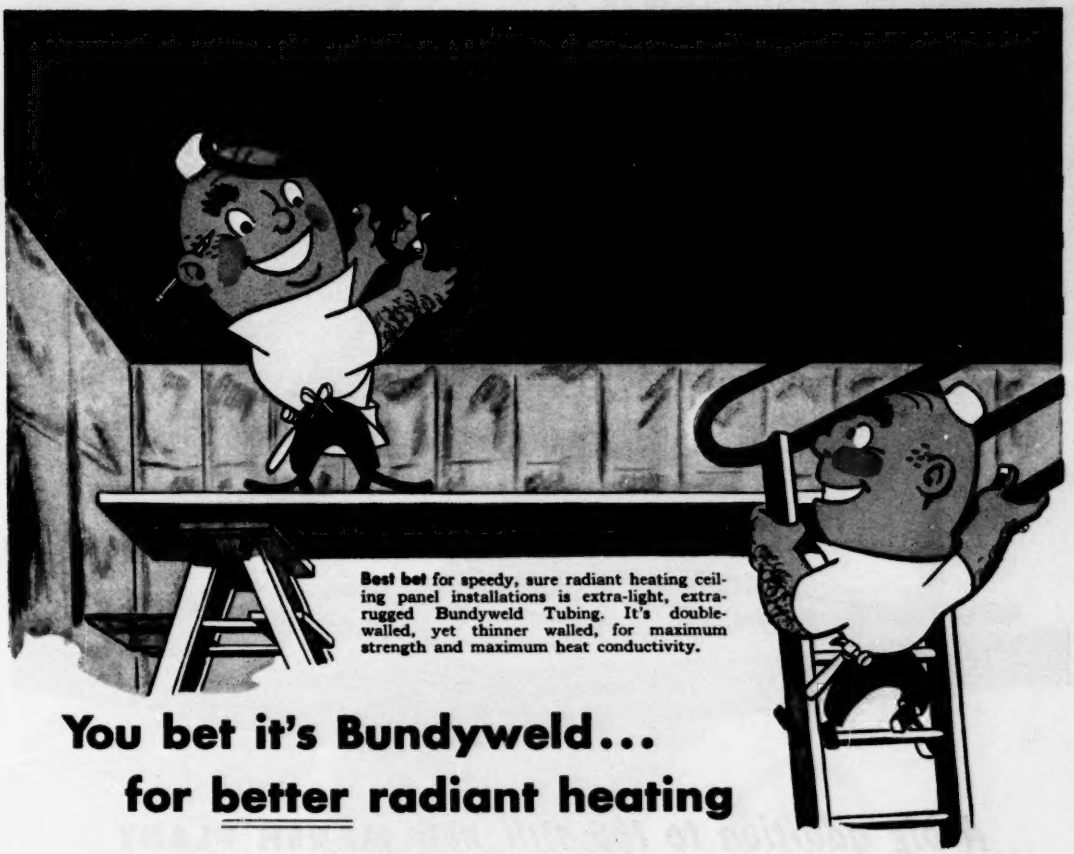
These controls are interlocked with the oil burners and arranged to shut down the boilers when no steam is required; and start the burners when any one section calls for heat. ILLINOIS valves, traps and controls maintain even temperature and continuously warm radiation, fully or fractionally filled to balance the vagaries of the climate.

Write for Bulletins

ILLINOIS ENGINEERING COMPANY

INCORPORATED 1900

RACINE AVENUE AT 21ST STREET • CHICAGO 8



Best bet for speedy, sure radiant heating ceiling panel installations is extra-light, extra-rugged Bundyweld Tubing. It's double-walled, yet thinner walled, for maximum strength and maximum heat conductivity.

You bet it's Bundyweld... for better radiant heating

Your best bet for better radiant heating panel installations is amazing Bundyweld Tubing.

And here's why—*no other tubing can match all the advantages Bundyweld offers, for no other tubing is made like Bundyweld!*

It's double-walled from a single strip, a patented construction that gives it the sturdiness to withstand the jars and jolts on the job. It's thinner walled, too, for maximum heat conductivity. It's lightweight, ductile, easy to shape and a cinch to solder or braze. Right from its arrival on the building site, you get major savings in labor and costs all down the line with dependable Bundyweld.

There's more, too

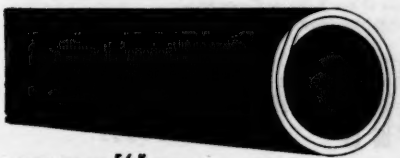
With a coefficient of thermal expansion very close to that of average plaster mix, Bundyweld can be installed without plaster worries. Painting offers no headaches, either, when normal precautions are exercised in installation.

Check on Bundyweld Tubing now . . . your best bet for better radiant heating installations. Write: ***Bundy Tubing Company, Detroit 14, Michigan.***

Bundyweld® Tubing

DOUBLE-WALLED FROM A SINGLE STRIP

WHY BUNDYWELD IS BETTER TUBING



SIZES UP TO 5/8" O.D.

Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .

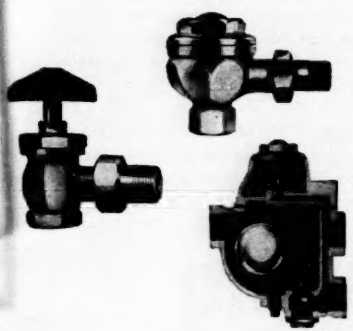
continuously rolled twice around laterally into a tube of uniform thickness, and

passed through a furnace. Bonding metal fuses with basic metal, presto—

Bundyweld . . double-walled and brazed through 360° of wall contact.

A big addition to the still new MARSH PLANT

25% more service-for-you space —



The quality and dependability of Marsh Packless Radiator Valves and Traps has been proved in hundreds of thousands of installations. The Marsh No. 8 Float and Thermostatic Trap, illustrated, is only one of a wide line of Marsh Traps covering practically all conditions. *Write for new catalog.*

It seems almost yesterday (actually 1948) that we announced the completion of our new modern plant at Skokie, Ill., close-in suburb of Chicago. And now we are announcing the completion of a large addition to this *still new* plant!

Such swift expansion is no mere happenstance. Long before we built our Skokie plant we had planned it down to the last detail to give new scope to the production principles that have enabled Marsh products to set their own standards . . . for quality . . . for downright *value.*

How well we accomplished our objectives—how much we exceeded even our own expectations—is convincingly attested by the need for this big addition to keep pace with the ever-accelerating demand for Marsh instruments, heating specialties, and refrigeration equipment.

This increased manufacturing space will provide facilities to maintain Marsh quality standards while giving you Marsh products at a faster pace. It is 25% more service-for-you space.

MARSH HEATING EQUIPMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
DEPT. U, SKOKIE, ILL.

MARSH *Heating Specialties*
SINCE 1865

IT ALWAYS PAYS TO SPECIFY

LADISH

Controlled Quality

PIPE FITTINGS

TO MARK PROGRESS

...you know they are in to stay

Long, trouble-free piping service results from extra safeguards in the manufacture of Ladish fittings. Rigid laboratory controls over chemical composition and physical properties of steel provide an assurance of maximum strength and resistance to erosion or corrosion. These are some of the extra safeguards for dependable operation which you always get in greatest measure in Ladish Controlled Quality Fittings.

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
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District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
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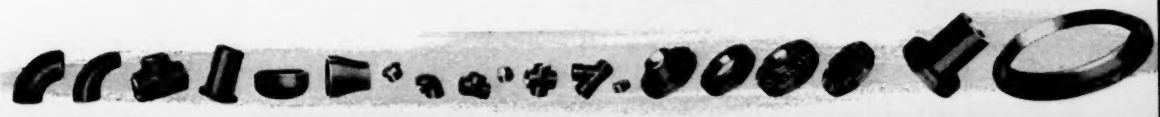

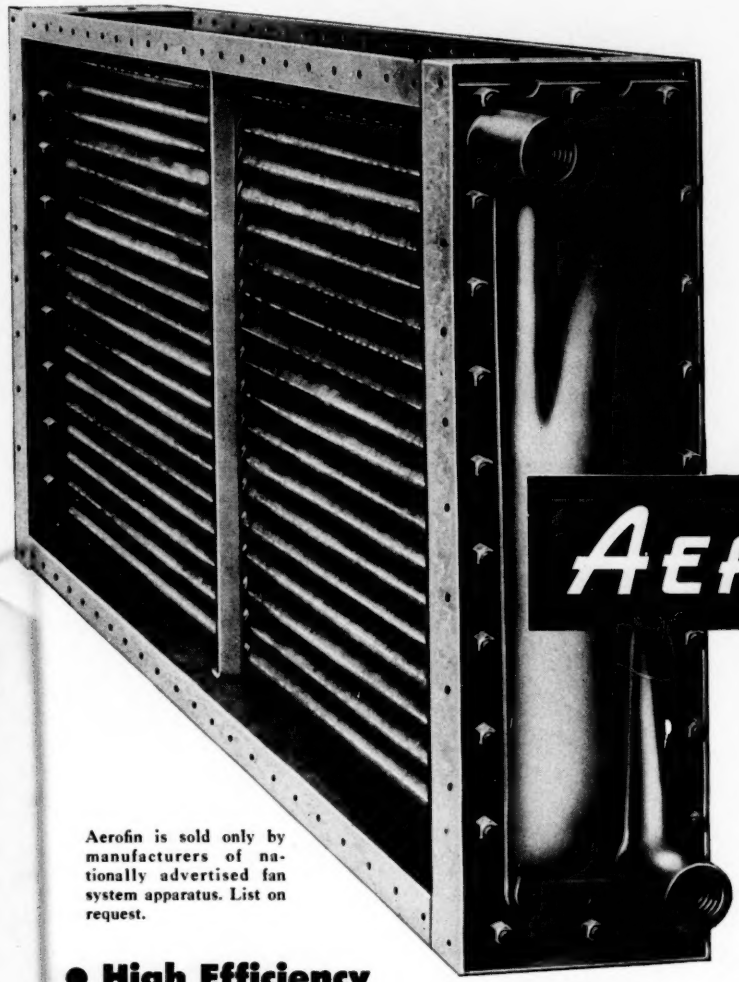

AEROFIN

Heat-Transfer Surface

Aerofin is sold only by manufacturers of nationally advertised fan system apparatus. List on request.

● High Efficiency
● Long Service Life
● Low Maintenance Costs

You are assured of high efficiency in heating or cooling — long service life — low maintenance and service costs, when you specify Aerofin extended-surface heat exchangers.

The reason is obvious: Aerofin makes heat exchangers *exclusively* — offers you the results of unequalled experience, unequalled production facilities, unequalled materials testing and design research — and the guidance of a complete, highly skilled engineering staff, at the plant and in the field.

For the most practical solution to your heat-exchange problem, ASK THE AEROFIN MAN.

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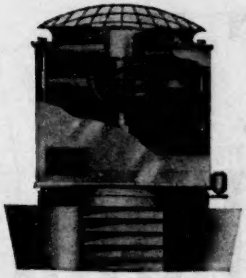


The New Wing Turbine Revolving Unit Heater

This new product of L. J. Wing Mfg. Co. is the logical result of constant improvements in two specialized lines of equipment pioneered by this company.

The first Wing turbine was built as an integral part of the Wing forced draft blower over 40 years ago. The first lightweight ceiling-suspended downward discharge unit heater was introduced by Wing over 25 years ago.

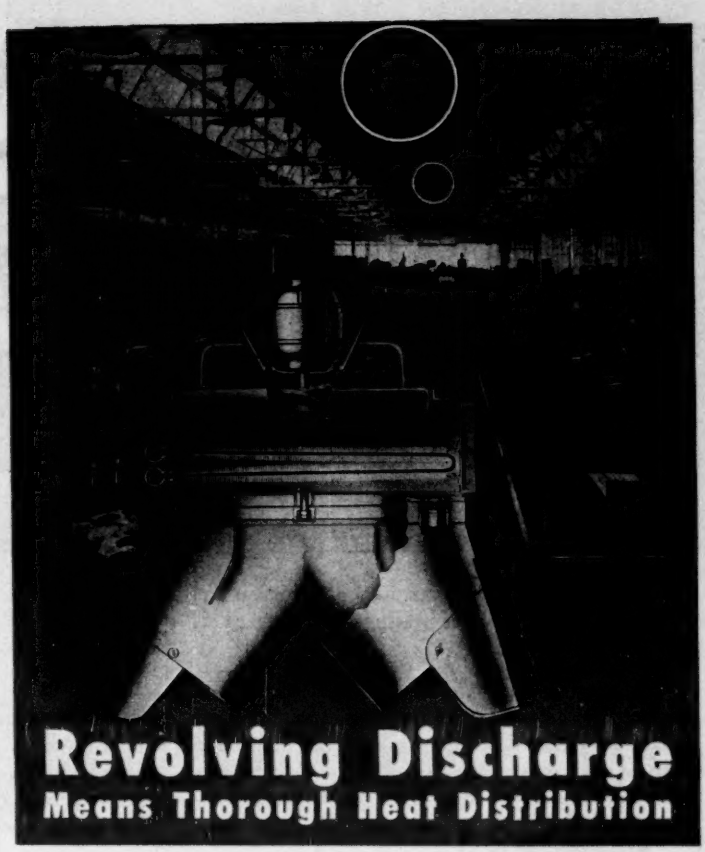
With the addition of the patented revolving discharge outlet in 1935 the next major step in the Wing program of constant improvement is the Wing Turbine Driven Revolving Unit Heater now offered.

In this, the fan is driven by the new Wing Allsteel Steam Turbine operating at any pressure, and the turbine exhaust is piped into the heater section. Thus the steam condensed in heating the air has first been used to operate the fan turbine.

Electric motor and electric power are eliminated.

Condensate from the heater is never at a temperature exceeding 170°F. even with air inlet temperatures as high as 100°F. Condensate is returned to the boiler through an open return system.

The entire unit is so designed that there is no back pressure on the turbine, assuring against leaks without the use of power-absorbing, troublesome packing. This also eliminates the need for traps and extra piping.



Revolving Discharge Means Thorough Heat Distribution

There are three types of Wing Revolving Discharge outlets, two of which are shown here. No. 8 for high ceilings is shown in the cross-section. No. 4 for medium heights in the factory scene.

As contrasted with the stationary unit heater, which projects air in one or more fixed directions, the Wing revolving discharge outlets move slowly through a complete circle discharging heated air in constantly changing directions — reaching every inch of plant area with fresh, invigorating warmth. Hot blasts and chilly areas are eliminated, assuring maximum comfort for employees and more production for the plant owner. Write today for Bulletin HR-5 describing in detail how Wing Revolving Heaters can put an end to your plant heating problems.

L. J. Wing Mfg. Co. 158 Vreeland Mills Road, Linden, N. J.

Factories: Linden, N. J. and Montreal, Canada

In Europe: ETABLISSEMENTS WANSON, Haren-Brussels, Belgium

Wing

Revolving

UNIT HEATERS

DO YOU WANT TO REDUCE YOUR FUEL OPERATING COSTS?

Then take advantage of this FREE engineering service

Anthracite Institute offers building management and managing engineers a free heating survey regardless of what fuel is used.

As part of this survey an accredited combustion engineer will inspect your plant, without cost or obligation. He will provide you with an engineering analysis which covers the size and type of fuel which your plant should or could burn for maximum efficiency. He will check present controls, draft regulators; he will survey the over-all condition of the boiler and check firing methods. He will check air elimination and combustion efficiency by flue gas analysis.

Following this comprehensive engineering analysis he will submit a detailed report to you or your agent. Included with the report will be the benefit of his personal counsel if it is wanted—and there will be no charge for any part of this service.

Smoke Control

If you have trouble with smoke this engineering analysis will be of particular value to you. The analysis and following report will combine to show you the quickest and safest way to eliminate any smoke nuisance. All methods will be considered including the advisability of changes in firing methods, the adaption of mechanical firing, as well as changes in size or mixtures of fuel.

This testimonial indicates the value of this service

Here is a typical example of what a satisfied user has to say—

"We wish to thank you for the 8 reports which you sent us covering the maintenance and operation of the steam plants in those buildings. We intend to carry out most of your recommendations and are confident that it will help us to reduce the fuel costs in these buildings. Several of the recommendations are items which had never been called to our attention before and will be helpful . . . in improving the efficiency of the plants in other buildings which you did not inspect."

. . .

Phone or write today to Anthracite Institute, 101 Park Avenue, New York 17, New York to have a free engineering analysis of your heating system.

ANTHRACITE INSTITUTE

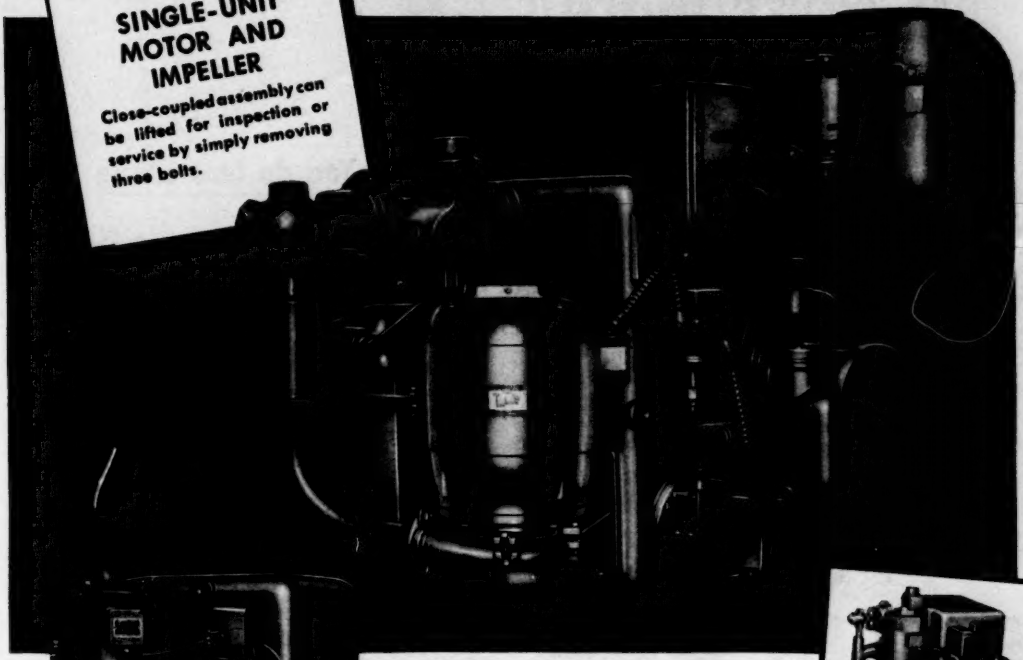
101 Park Avenue • New York 17, N. Y.

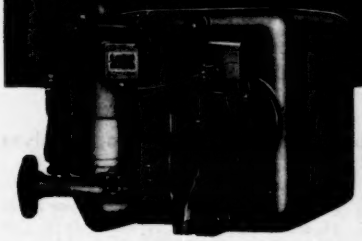
NEW!

SINGLE-UNIT MOTOR AND IMPELLER

Close-coupled assembly can be lifted for inspection or service by simply removing three bolts.

HOFFMAN • ECONOMY
CLOSE-COUPLED PUMPS





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• ECONOMY

Close-Coupled Vacuum & Condensation Pumps

NOW—you can specify a genuine Hoffman-Economy Vacuum or Condensation Pump *where price is a factor* and benefit from the long, care-free service for which these pumps are noted. The new, one-piece pump head and motor mounting is a single casting, accurately machined to assure permanent alignment between pump and motor. The entire assembly can be easily removed *without disconnecting any piping.* Lower *first cost*—and *less man-hours* for servicing. The bronze impeller and casing have hand-finished water passages to minimize friction. The casing is equipped with a bronze wearing ring—a *long-life feature seldom found in low-price pumps.* These are just a few of the quality design features to be found in Hoffman-Economy Close-Coupled Pumps—now available. Write for prices and literature.

TYPE VV VACUUM PUMP

TYPE E CONDENSATION PUMP

TYPES B & C CONDENSATION PUMPS

TYPE S CONDENSATION PUMP

It costs more to fix piping now!

No. 1615 Diaphragm Valve
Iron Body, Neoprene lined

You do less fixing

by using Dependable Quality

CRANE VALVES

. . . That's why more Crane Valves are used than any other make

better performing diaphragm valves

Separate disc and diaphragm design distinguishes these Crane Valves from all similar packless types. Life of diaphragm is multiplied because it's used only to seal the bonnet—not for seating. The separate disc seats the valve, eliminating wear and tear on the diaphragm.

Increased flow capacity . . . reduced flow resistance . . . tighter seating . . . lower torque and fewer turns to operate . . . are typical added features of Crane Diaphragm Valves. Wherever you use them, you can be sure of outstanding performance.

Such better quality and greater dependability mark Crane valves and fittings of every type—and assure the lowest ultimate cost.

CRANE

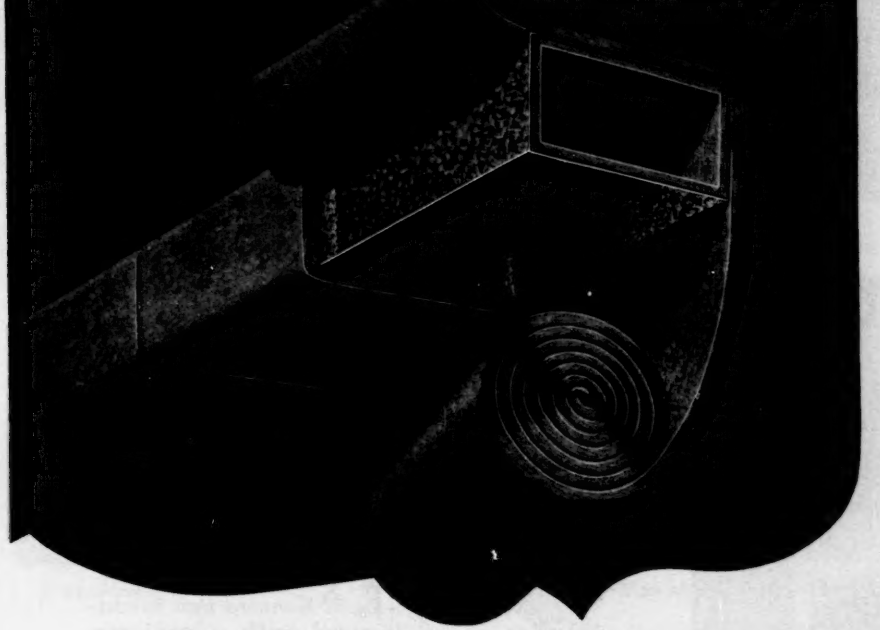
CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

Wrap your troubles in

ULTRALITE

DUCT INSULATION and DUCT LINER



and deliver better jobs . . . faster . . . cheaper!

Just *once,* try Ultralite, the long glass fiber insulation—and you'll never use any other insulation! For Ultralite goes on *faster, easier, cheaper* . . . and it does a better job of deadening sound and keeping heat and cold where they belong.

No need to handle Ultralite with kid gloves, for it's tough, resilient — won't break, flake, chip or dent. You can cut it readily with a knife, wrap ducts as you would a package. You can run it quickly around curves and corners. You can fasten it in place with wires or metal screws and washers or cement. And Gustin-Bacon offers *six different vapor barrier facings,* one of which is tailor-made for your particular condensation problem.

The superior thermal and acoustical properties of Ultralite in various thicknesses and densities are readily apparent from the charts in A.I.A. file No. 37-D-2. You'll like, too, the physical properties of Ultralite. The long glass fibers are fire-resistant, non-corrosive, non-irritating and as permanent as glass itself. Ultralite will not settle, shake loose, delaminate or disintegrate under air movement or vibration, nor will it pick up odors. Try Ultralite in your shop . . . soon!

For free samples and A.I.A. file No. 37-D-2, WRITE TODAY!

Please send me samples of Ultralite and A.I.A. file 37-D-2. Dept. HV-2

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GUSTIN-BACON MFG. CO.

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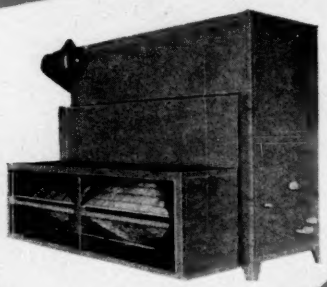
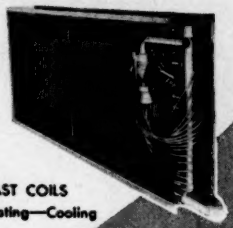
KENNARD *Engineered*

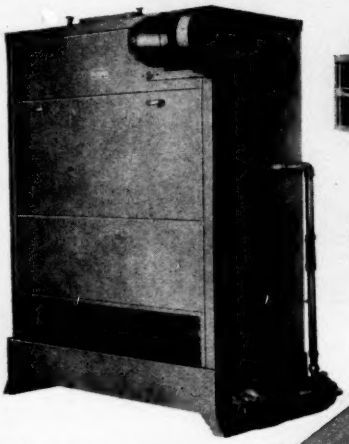
The Sign of *Quality*



AIR CONDITIONING UNITS
Vertical — Horizontal



BLAST COILS
Heating—Cooling



EVAPORATIVE CONDENSERS
Cooling Towers—
Induced Draft

Each Kennard unit is conceived with a pedigree. Never "how quick" or "how cheap". . . but always "How Good". Great consideration for long-lived, trouble-free operation . . . heavy stress on provisions for low cost installation and maintenance governs design.

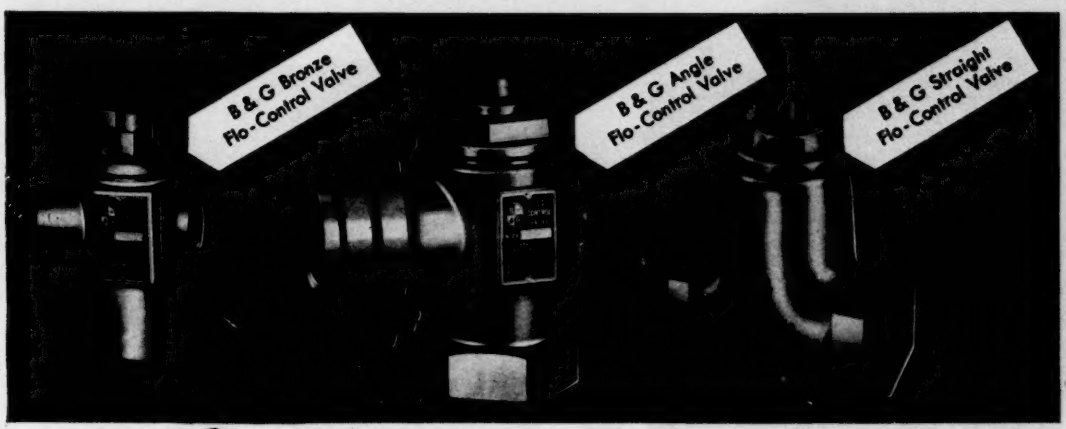
Non-corrosive coil frames, scale-free coils—(nitrogen atmosphere brazing of headers on D. E. Coils prevents scale and its abrasive effect on compressor), sectional galvanized Unit frames, Penta Post construction, multiple access panels, etc. . . . all are "Earmarks of Quality". . . evidencing that Kennard's objective is superiority of product in every way.

Write for Catalogs and Bulletins
No. 47A—FINNED COILS
No. 486—AIR COND. BLOWER UNITS
No. 491—EVAPORATIVE CONDENSERS
No. 494—COOLING TOWERS

"Refinement of Detail Marks the Difference Between Ordinary and Excellent."

Kennard D. E. Coils bear Underwriters Laboratories, Inc. approval

KENNARD CORPORATION • 1823 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.



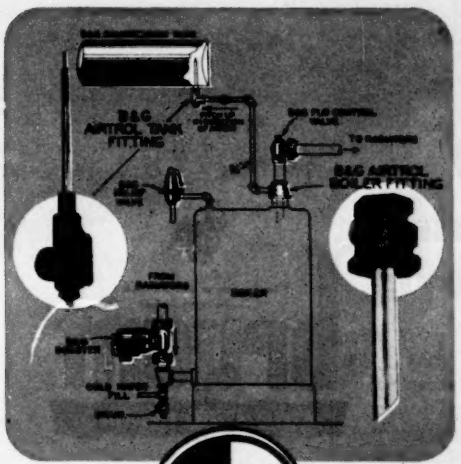
THE *Only* FLO-CONTROL VALVES WITH THIS EASY-CLEANING FEATURE

1 Unscrew the top cap

2 Lift out entire valve mechanism

3 Wipe off the seat

4 Replace the top cap



Cleaning the seat of a B & G Flo-Control Valve is a quick, easy job—*no pipe connections to break!*

The four simple steps illustrated above tell the story. *Unscrew the top cap—lift out the entire valve mechanism—wipe off the seat—replace the cap and the job's done!*

With B & G Flo-Control Valves you can also meet any piping problem the easy way—because you have a choice of either straight or angle patterns. Both kinds can be quickly adjusted for either automatic operation or gravity circulation. Size and capacity information is given in the B & G Catalog—write for your copy.

B & G AIRTROL SYSTEM

Removes air from a hot water heating system and keeps it out!

A really sensational cure for air trouble—proved successful in countless actual installations.

The B & G Airtrol System consists of two units—the Boiler Fitting and the Tank Fitting. Their combined function is to trap air in the compression tank and prevent its return to the boiler, piping and heat distributing units. The Airtrol System can be installed on any cast-iron or steel hot water boiler.

Hydro-Flo PRODUCTS

Forced Hot Water Heating Equipment . . . Heat Exchangers . . . Water Heaters . . . Centrifugal Pumps . . . Refrigeration Equipment

BELL & GOSSETT COMPANY

Dept. BX-4, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Road, Toronto, Canada

*REG. U. S. PAT. OFF.

Bryant Model 322 Unit Heater with A.G.A. inputs of 110, 135, 175, 210 thousand Btu per hour.

How to cut maintenance *Overhead*

Best bet for your industrial or commercial heating installation is *the* unit heater you can sell on the basis of *least maintenance.* That's where your customer looks for long-range economy and lasting satisfaction.

Tell him of the trouble-free operation of Bryant Gas Unit Heaters . . . how their specifically designed unit heater controls eliminate failures . . . how proper heat exchanger design prevents burnouts and squeezes a maximum of heat from every dollar's worth of fuel . . . how simple, time-saving installation of these Bryants meets his needs for comfort heating that's quick, automatic and without waste. These advantages mean *savings* for him.

And, once installed, you can count on these Bryant Unit Heaters for fewer call-backs . . . less trouble *overhead.* That's money in the bank for *you!*

For a more complete story, contact the Bryant Distributor nearest you or write direct. Bryant Heater Division, Dept. 161, Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, O.

Let the pup be furnace man . . . and water boy, too!

bryant

AUTOMATIC HEATING

Your *single* source of supply for everything in gas heating equipment!

Remember—only genuine TUBE-TURN Welding Fittings are identified by these trade marks!

tt and TUBE-TURN are trade marks of Tube Turns, Inc.

Unique forging process gives strength

TUBE-TURN WELDING FITTINGS have a close-grained metal structure fully as strong as the pipe to which they are welded. Welding elbows, for example, are forged by the only process that achieves wall thickness as uniform as the original seamless pipe . . . guaranteeing *full strength throughout*. And, their true circularity means accurate alignment, regardless of angle, for strong, tight, permanently leakproof connections.

Forged-in strength is inherent with all types of TUBE-TURN Welding Fittings. It's one of the big reasons why it pays to specify them for *all* jobs. Get in touch with your nearby TUBE TURNS' Distributor. You'll find one in every principal city.

Write Dept. B-2 for free booklet giving Dimensional Data on types, sizes and materials of TUBE-TURN Welding Fittings and Flanges.

"Be sure you see the double tt"

TUBE TURNS, INC. LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Houston • Tulsa • San Francisco • Los Angeles

TUBE TURNS OF CANADA LIMITED, CHATHAM, ONTARIO . . . A wholly owned subsidiary of TUBE TURNS, INC.

Wrought iron downspout welded on Cleveland Bridge

Cleveland's Abbey Avenue Bridge is big enough to collect a lot of water in a rainstorm. To get rid of it, nine downspouts, ranging from 39 to 66 feet in height, carry the water to underground sewers. Wrought iron pipe was chosen for its resistance to rust. All-welded piping was chosen for long life, structural rigidity. Weak joints here could be fatal!

Contractor on this job, the Gorman-Lavelle Company of Cleveland, likes speed on the job. The piping itself was quickly fabricated on the ground, then raised into position. Piping went up fast—and safely!

A lateral connection near the top of the spout leads up to drains on the bridge. TUBE-TURN Welding Reducers are installed at the very top of the spout. The drain sets in the reducer with a loose fit, allowing 2" clearance all around. Thus the bridge can expand on its roller bed without disturbing the pipe. TUBE-TURN Welding Reducers, Elbows, Laterals and Caps are all part of the leading line in welding fittings.

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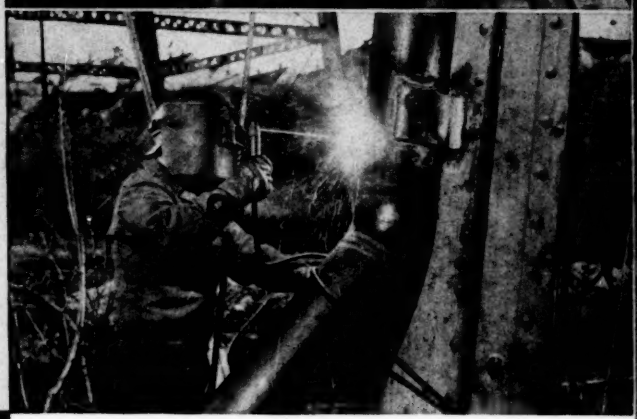
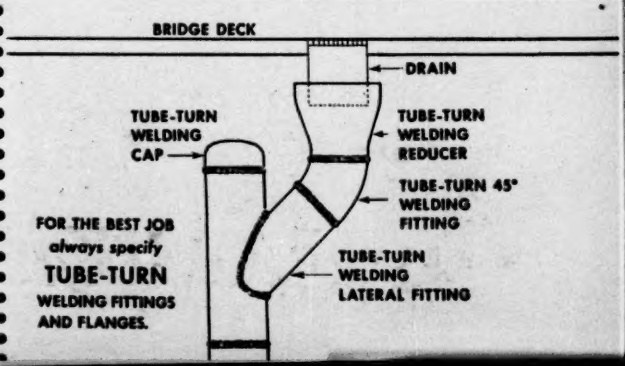


Note TUBE-TURN Welding Elbow at bottom of downspout. Drain pipe will be connected to underground sewer. Underground, too, a system welded with TUBE-TURN Welding Fittings is the best long-term bet—there are no threads to corrode, the problem of leakage is eliminated.


BRIDGE DECK
DRAIN
TUBE-TURN WELDING CAP
TUBE-TURN WELDING REDUCER
TUBE-TURN 45° WELDING FITTING
TUBE-TURN WELDING LATERAL FITTING
FOR THE BEST JOB always specify TUBE-TURN WELDING FITTINGS AND FLANGES.

TUBE TURNS, INC., Dept. B-2
224 East Broadway, Louisville 1, Kentucky

Your Name .....

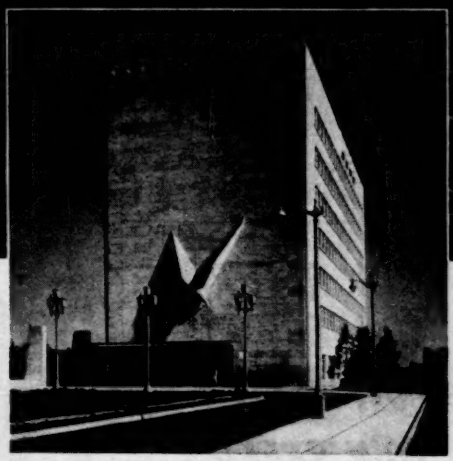
Position .....

Company .....

Nature of Business .....

Address .....

City ..... *State* .....



Lounge and exterior, Veterans Memorial Building, Detroit, Mich.
Architects and Engineers: Harley, Ellington & Day, Inc., Detroit, Mich.
General Contractors: Kuhne-Simmons Co., Inc., Detroit
Air Conditioning Contractors: American Refrigerating Co., Detroit

Simply beautiful

kno·draft
adjustable air diffusers

In their beautiful simplicity of line, Kno-Draft Adjustable Air Diffusers are grace notes for any decorative theme. But unless you just happened to look ceilingward, you might not ever notice them in the modern lounge above. Nor would they be more obtrusive in period surroundings.

Certainly, Kno-Draft Adjustable Air Diffusers will never call attention to themselves by discomforting the occupants of any room. All that their name implies, Kno-Draft Adjustable Air Diffusers circulate air gently and *without draft* . . . keep temperature uniform throughout the conditioned area. Air volume and flow pattern are adjustable *after* installation . . . thus simplifying the engineering of the job as well as providing flexible control to meet both present and future conditions.

You'll find Kno-Draft Adjustable Air Diffusers in many of America's notable and architecturally significant buildings. Whatever the air conditioning requirements, there are types and sizes to meet them. Write us for detailed information.

KNO-DRAFT DATA BOOK: Complete specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. To get your copy, simply fill in and mail the coupon. No obligation, of course.

TRADE MARK "KNO-DRAFT" REG. U. S. PAT. OFF.

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W. B. CONNOR ENGINEERING CORP.
Dept. J-21, Danbury, Connecticut

Please send me, without obligation, my copy of the Kno-Draft Air Diffuser Data Book.

Name .....
Position .....
Company .....
Street .....
City ..... **Zone** ..... **State** .....

TVC CONDENSATION weil PUMPS

AVAILABLE FROM JOBBERS STOCK

for low pressure systems
steam mains-heating systems
water heater coils

- *LOW RETURN CONNECTIONS*
- *LOW WATER LINE*
- *LOW SPEED LONGER LIFE*
- *CAST IRON RECEIVER single or duplex*

Fig. TVC-302

*TVC low return connection simplifies layout

- Permits overhead lines
- Eliminates underground lines
- Capacities 500 to 10,000 sq. ft. E.D.R.
- All Bronze Pump Head

*NRG underground condensation pumps

- Cast Iron Receiver
- Low Return Connections
- Installed in the ground
- Requires limited space

*WRITE FOR BULLETINS TVC-300 and NRG 200-B

weil PUMP COMPANY 1523 N. Fremont St. Chicago 22, Illinois

Yours for the asking—

A VOLUME OF DATA

. . . covering welding fittings and forged steel flanges . . .

ON A SINGLE SHEET

Here is just about the handiest tool ever devised for the pipe designer. Data on welding fittings and flanges that otherwise could be found only by plowing through many catalog pages and tables have been ingeniously condensed on the two sides of the durable letter-size card illustrated above.

One side covers the broad WeldELL line of Taylor Forge welding fittings. For every nominal pipe size, ½" through 30", it shows the wall thickness for every weight of every fitting in every available material. It also shows all required dimensions of all types of fittings.

The other side covers the world's most complete line of forged steel flanges. For every nominal pipe size, ½" through 24", it gives all essential dimensional and bolting data for all types of flanges in all weights. A particularly useful table (see reproduction) is that showing welding neck flange bores which enables you to determine the I.D. of any nominal pipe size without separate calculation. Thus the sheet gives you O.D. and I.D. of any weight of pipe.

The card is varnished to make it stand the steady usage you are certain to give it. To obtain your copy see your Taylor Forge distributor or **MAIL THE COUPON.**

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Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada

Please send me one of your fitting and flange sheets!

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POSITION_____

COMPANY_____

STREET ADDRESS_____

CITY_____ ZONE____ STATE_____

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Here's a real "mechanic's garage"

radiant heating with National Steel Pipe assures warm floors . . . maximum comfort . . . at low cost

● The Kuykendall Chevrolet Company garage, in Lubbock, Texas, is skillfully designed with two important things in mind: High efficiency, for low operating cost; and maximum comfort, for higher worker output.

You can't beat radiant heating for attaining such results. It provides warm floors and uniform, comfortable temperatures throughout—ideal for garage work. Radiant heating eliminates above-floor heating units and makes the entire working area available. There are no obstructions, no hot spots, no cold areas or damp floors to handicap operations. These advantages have lead to the increasing use of radiant heating in modern garage construction.

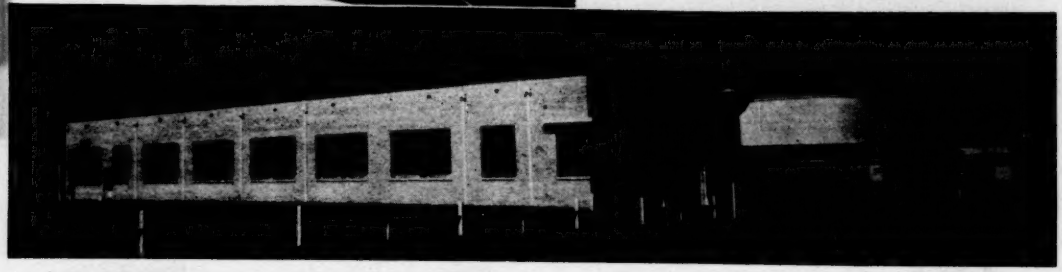
Steel pipe is unequalled for radiant heating installations. It's strong and ductile for easy bending. It's ideal for making welded joints. And steel pipe is so strong that it's hard to damage during installation. Best of all: it's durable in service and economical to use. When you buy National Steel Pipe, you're buying the same reliable steel pipe that has been the standard for conventional heating for more than sixty years.

If you are planning a radiant heating installation in a garage, store, terminal, factory, warehouse or plant, be sure to get all the advantages of using National—world's largest selling pipe.

Write today for our free 48-page book on Radiant Heating. It includes data for estimating heat losses, designing coil systems for floor and ceiling installations, typical coil patterns, testing procedures, fitting resistances, insulating techniques, pipe data and heat transmission tables. Ask for Bulletin No. 19. National Tube Company, Frick Building, Pittsburgh 19, Pa.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

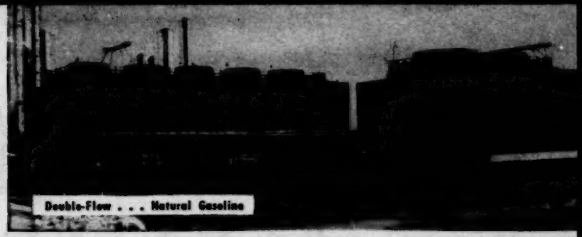


USS

NATIONAL Steel PIPE

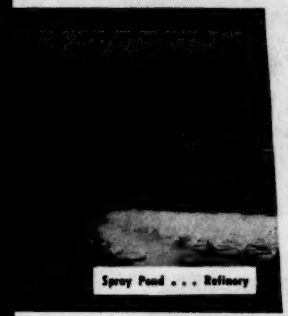
UNITED STATES STEEL

Double-Flow . . . Atomic Energy

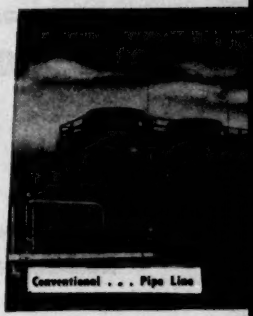


Double-Flow . . . Natural Gasoline

WHAT IS YOUR COOLING PROBLEM?

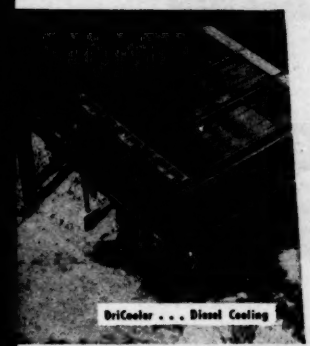


Spray Pond . . . Refinery



Conventional . . . Pipe Line

IS IT COST? Cooling towers or DriCoolers can have a low first cost with higher operating cost and vice versa. Or, you can get an economical combination of both. Marley application engineers have a complete line of units to select from and the "know-how" to help you make the best selection for your purpose.



DriCooler . . . Diesel Cooling

IS IT SPACE? Marley equipment may be installed indoors or outdoors. Units are available with large base area and low height to give light loading per square foot or with small base area and greater height to fit in small area.

IS IT TEMPERATURE? Usually, it is not economical to cool lower than a 5F approach to the wet bulb. However, in Marley cross-flow towers a quantity of water at wet bulb temperature may be obtained without added cost. For high level cooling, the DriCooler is applicable.

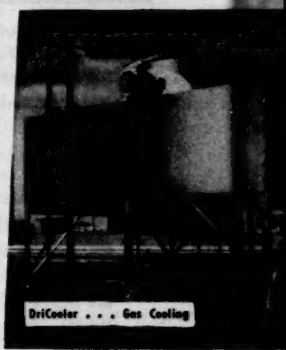
Vairflo . . . Refrigeration

IS IT LOCATION? Extreme temperatures, cold or hot, dust, wet bulb, altitude, brackish water, wind, storm conditions, or lack of proper water supply are problems that must be considered. Marley has a unit to fit any geographical condition.

Double-Flow . . . Power

IS IT APPEARANCE? Marley has a wide range of designs that will blend with any building architecture. Or even become a part of the building itself. Marley engineers can help your architect give you a good looking as well as efficient installation.

These are only a few of the problems you may face in the selection of a cooling tower or DriCooler. No matter what the problem, Marley Application Engineers have the answer to help you invest your dollars wisely and profitably.



DriCooler . . . Gas Cooling

MARLEY

Natural Draft . . . Air Conditioning

HV-

Write, Wire or Phone The Marley Company, Inc., Kansas City 15, Kansas.

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Company _____

Address _____

City _____ Zone _____ State _____

☐ Please send "What's Your Cooling Tower IQ"

☐ Our Cooling Problem is _____

Aquatower . . . Air Conditioning

specify
ACME CONDENSERS

and you meet every sales requirement

Through practical experience and constant research Acme Engineers have developed a wide variety of models and sizes of Freon, Ammonia, Shell and Coil and Shell and Tube Condensers. The Acme Condenser Line is varied enough to permit the selection of the right model and the right size unit to meet *every* requirement.

FREON CONDENSERS

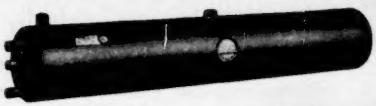
Exclusive method of tube support eliminates noise.
Easy to clean.
Leak proof joints.
Combination Heads.
More than 120 different sizes.
A.S.M.E. Certification.

MODEL SRF

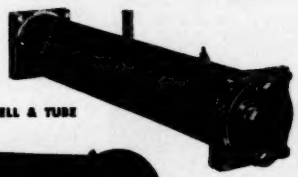
Shell & Coil and Shell & Tube CONDENSERS

Shell & Coil
Drainable Coils
Compact
Inexpensive

Shell & Tube
Cleanable tubes
Inexpensive
Compact
Dual Pass (J300 & larger)



SHELL & COIL



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AMMONIA CONDENSERS

Exclusive Locknut Construction Available
Rolled-in or Welded Tubes
A.S.M.E. Construction and Certification
Locknut Assembly for Easy Replacement
Custom Built

AMMONIA

These are only a few of the features and advantages that have made ACME Condensers the choice of the heavy refrigeration Industry for quality, design and lasting performance. Write for catalog on equipment you require.

ACME ALSO MANUFACTURES:

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* Trade Mark

ACME INDUSTRIES, INC.
Dept. HV
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ACME PRODUCTS

continuously serving the refrigeration industry since 1919

Washington News

LORING F. OVERMAN

IT is a bit early to look back on the month of January and determine which of many Washington actions was most significant from the standpoint of the heating, ventilating and air conditioning industries.

At first glance it would seem that NPA's amendment to Construction Order M-4, effective January 13, may win the nod. The order established a system under which virtually all new private commercial construction requires prior approval by NPA before work can be started. Despite this order, however, construction industry forecasters are predicting that 1951 will be second only to 1950 in building volume.

Other developments of tremendous importance were the price and wage freeze preparations, set into motion at top speed when Eric Johnston, former motion picture czar, replaced Alan Valentine as head of the Economic Stabilization Administration. Mr. Valentine was accused, pricewise, of fiddling around with voluntary controls while business and labor built a fire under prices and wages. In winning Senate confirmation of his appointment by President Truman, Eric Johnston committed himself to speedy control of prices and wages together.

Another January happening of great significance was President Truman's State of the Nation message to the new Congress. In it he presented a 10-point program requiring "must" legislation. It was noticeable, however, that 9 of the 10 points were concerned with defense problems. This fact, together with Eric Johnston's acceptance of what is conceded to be the meanest assignment in Washington, left observers with the feeling that things are plenty serious with this country of ours, and that Washington expects business and the citizenry in general to dig in and do something about it.

It will be recalled that Eric Johnston, a former president of the United States Chamber of Commerce, is customarily considered a spokesman for business. To find him ready and willing to take the brickbat barrage which, in the past, has driven price administrators into oblivion, is significant if not reassuring.

Another Washington happening which can hardly be passed up without considerable comment and misgiving is the President's budget request for $71.5 billion for fiscal '52. The President's State of the Union message implied that there would be a request for much heavier expenditures for defense purposes, but he also indicated that some of the non-defense items would be pared. When the budget message was read into the record, it was observed that the so-called Fair Deal ideas were still on the list. The sum total represented a prospective deficit of $16.4 billion to be raised by new taxes from some place or other. The House Ways and Means Committee has been fanning the air trying to figure some way in which $16.4 billion more in taxes might be raised without wrecking the economic system.

This, of course, raises the old question of at what level we reach a point of diminishing returns. As one businessman is said to have voiced it, "Where is my inducement to produce more?" To this, Stuart Symington, chairman of the National Security Resources Board is reported to have replied, "Your inducement, my friend, is saving your neck."

So it all resolves itself back to the conclusion that only one thing matters nowadays, and that is preparation for the defense of the United States against come what may. Such being the case, let's look at some of Washington doings during January.

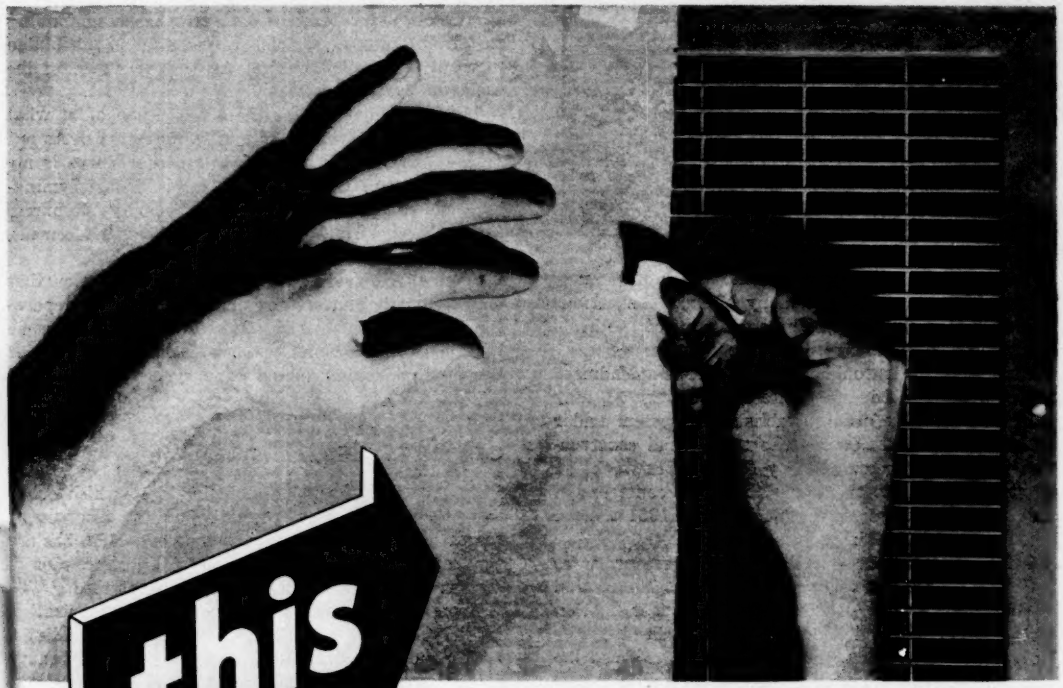
Construction Curb

To its basic Construction Order M-4 (which originally prohibited a long list of projects for amusement, recreational or entertainment purposes), NPA has appended a List B, including commercial projects requiring prior approval before work can be started.

Types of construction for which NPA authorization will be required include banks, office and loft buildings, hotels, motels and tourist camps, barber and beauty shops, garages, service stations, laundry and dry cleaning establishments, shoe repair and tailor shops, undertaking and cemetery buildings, community and neighborhood buildings, restaurants, printing shops, and facilities for the storage, distribution, display or sale of consumer goods, including all retail stores and shopping centers, and storage warehouses for personal effects. The order places no restrictions on the construction of wholesale food establishments or wholesale supply facilities for fuel oil, gasoline, coal, gas distributing systems, and pipelines. The order continues provisions permitting new construction and alterations costing not more than $5,000 in a 12-month period, and necessary expenditures for ordinary maintenance and repair.

A reading of the order reveals that NPA has put a very heavy finger upon just about all of the more popular outlets for air conditioning equipment. The original M-4 order dried up such outlets as theaters, night clubs, bowling alleys, swimming pools, and similar projects. The new order goes the rest of the way insofar as commercial buildings are concerned. Specifically mentioned are types of buildings where air conditioning has become known as a must—hotels, restaurants, retail stores—to mention only a few.

There are indications that this order, like some others in the defense series, seeks the power to prohibit certain construction, while at the same time providing loopholes permitting regional NPA offices to grant construction permits under stated conditions. NPA officials have said that in considering an application to commence construction of a commercial facility not related directly to the defense effort it will take into account the type and quantity of materials needed and on hand, as well as the effect on the community at large if the application should be rejected.



is as bad as dirty filters!

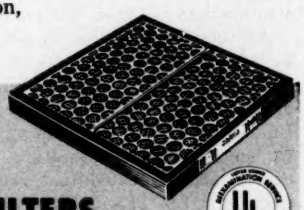
Get This Booklet—The "Comparative Study of Air Filtering Costs" contains facts, figures and charts important to anyone interested in air conditioning. A copy free on request. Write today.

You wouldn't deliberately block your air conditioning registers. And yet, leaving in dirty filters is just as sure a way to cut air flow—decreasing comfort and raising operating costs.

Regular, periodic replacement of air filters is a *must* if you want efficient air conditioning and low maintenance costs. How often should you replace them? As often as they get dirty . . . and that depends on your local conditions . . . in some cases as often as once a month.

Be sure your filter replacement is handled on a definite schedule, using nationally known and accepted Fiberglas Dust-Stop* Air Filters, the replacement filters that provide high dirt-catching capacity at no extra cost.

Your Dust-Stop supplier can help you set up a way of handling filters systematically. Discuss it with him today.
Owens-Corning Fiberglas Corporation,
Dept. 41-B, Toledo 1, Ohio.



OWENS-CORNING FIBERGLAS

DUST STOP* AIR FILTERS

*T. M. REG. U.S. PAT. OFF.

*Dust-Stop is the trade-mark of Owens-Corning Fiberglas Corporation for impingement-type air filters made of fibers of glass. FIBERGLAS is the trade-mark (Reg. U.S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass.

Defense Projects Fill In

General effect of the order will be to make more materials and labor available for defense and defense-supporting projects, particularly for the industrial plant expansion program now formulating, and for communities affected by military and industrial expansion. Observers feel, therefore, that most of the loss expected in private housing and in less essential building will be offset by gains in essential building and in military and civilian defense construction. Their guess is that dollar value of construction for 1951 will be about $24 billion—second only to the 1950 record of $27.7 billion—and an important total regardless of cuts.

Among activities which will take up the slack may be included the new Defense Housing Act, which is expected to add $3 billion in FHA mortgage insurance to encourage builders to construct new housing in defense areas. The bill, as now drafted, would permit government to step in and acquire sites and build homes in the event private industry does not respond.

The actual list of military and civilian defense projects is expected to assume tremendous proportions as the defense program jells. So convinced is the government that defense programs will claim the bulk of the construction industry's services that the Federal Reserve Board has further curbed privately financed multiple housing through amendment of Regulation X —specifying minimum down payments on new construction. Regulation X, as amended, includes a new schedule of minimum down payments to cover residential structures accommodating more than four families. The regulation covers real estate credit transactions in which no government insurance or guarantees are involved. Comparable action has been taken by the Federal Housing Administration and the Veterans Administration.

Mixed projects, such as apartments with stores in the same building, are subject to both Regulation X and the new NPA Amended Order M-4.

Industry Advisory Committee Meets

Members of the Air Conditioning and Refrigerating Machinery Industry Advisory Committee asked the National Production Authority in mid-January to give the industry advance notice of orders cutting back supplies of materials used by the industry, so that production schedules can be revised. They warned that sizable cutbacks in production of refrigeration equipment would make preservation of food supplies in new locations difficult, if not impossible.

The industry committee discussed the impact of the copper and aluminum orders on the industry, and expressed concern that cutbacks would reduce production and force layoffs of skilled workers who will be needed later when defense orders are received.

NPA said that the copper supply picture would remain tight, and that there was no immediate likelihood that aluminum supplies would ease until additional facilities are brought into production in about 18 months. A task committee was appointed to consider the problem of conservation of critical materials. As in all cases, this will involve a study of methods of substitution, simplification, salvage, and changes in specifications.

Industry members attending the meeting included W. M. Aubrey, Frick & Co., Inc., Waynesboro, Pa.; H. M. Brundage, General Electric Co., Bloomfield, N. J.; A. J. DeFino, Fedders-Quigan Corp., Buffalo, N. Y.; A. P. Shanklin, Carrier Corp., Syracuse, N. Y.; W. A. Siegfried, Superior Valve and Fitting Co., Inc., Tecumseh, Mich.; Will Hanford, The Bush Mfg. Co., West Hartford, Conn.; H. F. Hildreth, Westinghouse Electric Corporation, Springfield, Mass.; H. T. Jarvis, Refrigeration Engineering, Inc., Los Angeles, Cal.; George S. Jones, Jr., Servel, Inc., Evansville, Ind.; Lawrence N. Lucas, Bastian-Blessing Co., Chicago, Ill.; E. C. Marsden, Marsden and Wasserman, Inc., Hartford, Conn.; William B. McMillan, Hussman Refrigeration, Inc., St. Louis, Mo.; Orville Morrison, Sunroc Refrigeration Co., Glen Riddell, Pa.; F. E. Smith, Baker Refrigeration Corp., South Windham, Maine; W. F. Switzer, General Motors Corp., Frigidaire Division, Dayton, Ohio; R. J. Thompson, Kinetic Chemicals, Inc., Wilmington, Del.; Kenneth Weatherwax, Acme Industries, Jackson, Mich.; John H. Cooledge, Sherer-Gillette Co., Marshall, Mich.; R. H. Israel, Virginia Smelting Co., West Norfolk, Va.; and M. G. Munce, York Corporation, York, Pa.

Industry Role to be Documented

To document presentations made by the Industry Advisory Committee and other industry groups in convincing government of the part which refrigeration and air conditioning must play in a major defense effort, an elaborately illustrated 48-page book is being rushed to completion by the Air Conditioning and Refrigerating Machinery Association, Washington, D. C.

The book is being profusely illustrated with photographs, charts, graphs and other evidence of the constructive part the industry and its products play in national economy—in peace and in war.

Indications are that the book will not be completed a moment too soon, for the Defense agencies are just beginning to be staffed with what will eventually be thousands of men and women whose understanding of the industry will be as law as the program progresses. Such a project as the Air Conditioning and Refrigerating Machinery is completing may be an important factor in keeping the industry's products on the "right lists" for the duration of the emergency.

New Orders Pending

Scores of new orders—not the kind that put dollars in the bank, but those bearing NPA initials allocating important materials and denying their use for certain end purposes—are on their way through the Washington mill. Some are just off the presses; others are pending; still others will become business law as soon as staff and mechanics of control can be devised.

The latest revision of *NPA Order-1—the basic steel order*—dated January 22, hikes the percentage of steel capacity which must be devoted to filling "DO" orders

(Continued on page 143)

BRIEFLY STATED

• Residential air conditioning advanced recently with the announcement that a leading Cincinnati home builder had purchased 175 Servel year 'round air conditioners. This is the largest single order ever placed. The units will be installed in a new and exclusive suburb in Cincinnati—Meadow Ridge—where homes will range in price from $30,000 to $100,000.

• Charging that the Conant Plan or any similar program for universal military service would "eat up America's seed corn," i.e. the country's scientific and engineering manpower, the Engineering Manpower Commission of the Engineers Joint Council proposed today the establishment of a National Engineering Personnel Board to make selections for military, civil defense or industrial allocation from a reserve of men up to the age of 70 with training in one of the critical fields of engineering. The Engineering Manpower Commission asked that the reserve be created through the registration by selective service of every man up to the age of 70 who has a bachelor's degree with a major in one of the critical fields of engineering or who is enrolled in a program of training leading to a bachelor's or higher degree in one of these fields, or who is employed in one of these fields.

• Election of R. E. Lucey and H. C. Rooks as vice presidents of The Trane Co. has been announced. E. A. Cline was named sales manager. R. E. Haskins succeeds Mr. Cline as manager of convector-radiator sales.

• W. A. Matheson has been appointed director of dealer relations of the recently organized American Bildrok Co., manufacturers of lightweight aggregate building materials.

• The American Air Filter Co., Inc., Louisville, Kentucky, has announced the appointment of John M. Kane as manager of the Dust Control Division. He joined the company in 1933 after graduating from the University of Kentucky with a B.S. in Mechanical Engineering and was made chief engineer of the Dust Control Division in 1944.

• The Newcomen Medal "for achievement in the field of steam" was awarded to Isaac Harter, chairman of the Board, The Babcock & Wilcox Tube Co., Beaver Falls, Pa., at a joint meeting of the Newcomen Society and The Franklin Institute in honor of Benjamin Franklin's birthday, January 17. This was the second time the medal had been conferred, the first being to Rear Admiral Harold G. Bowen, U.S.N., in 1944. Among Mr. Harter's achievements was a development which removed the cause of corrosion which had been preventing use of steel economizer tubes. Formerly the tubes were of cast-iron which could withstand only 200 lb pressure.

• Appointment of Robert C. Black as advertising manager of the Machinery Division of Dravo Corp., Pittsburgh, has been announced by William H. Collins, the corporation's director of advertising. Dravo's Machinery Division includes heating, ventilating, air conditioning, power plant, piping and heavy industrial equipment departments. Mr. Black formerly was on the staff of the vice president of Westinghouse Electric Corp. and had served as advertising and sales promotion manager for the southeastern district of Westinghouse at Atlanta, Ga.

• Texas Gas Transmission Corp. is increasing its daily natural gas deliveries by 60 million cu ft. The company said the increase is made possible by completion of a compressor station construction program begun several months ago. The 2400-mile Texas Gas system now serves the Mississippi and Ohio River areas with over 700 million cu ft of gas a day. Earlier, Texas Gas announced a $42.3 million pipe line construction program calling for the construction of 580 miles of large diameter pipe line.

• Hamilton-Thomas Corp. of Hamilton, Ohio, has announced the acquisition of the capital stock of the C. H. Wheeler Manufacturing Co., Philadelphia. No change in the operation of either company is contemplated.

• Eldon E. Fox has been appointed advertising manager of the Minneapolis-Honeywell Regulator Co., H. D. Bissell, director of mechandising, has announced. Mr. Fox has left Young and Rubicam, Inc., New York, to take the new position. A graduate of Dartmouth College and the Harvard Graduate School of Business, he joined Young and Rubicam in 1941 and served in various departments, including media and research and later as account executive for several accounts. In his last position with the advertising agency, he was account executive for Corning Glass Works and Time and Life magazine accounts.

• Wesley J. Peoples, chairman of the board of United States Radiator Corp., has announced that the company has purchased the business and assets of the Cyclotherm Corp., Oswego, New York, manufacturers of packaged steam generating units used particularly for high pressure industrial application. Cyclotherm will be operated as a separate division of U. S. Radiator, and no change in its products or methods of distribution is anticipated.

• The New York State Building Code Commission has established liaison with top officials of agencies in the thirty-six other states concerned in some way with building regulations on a statewide basis, it was announced by George Bain Cummings, vice chairman of the Commission.

The purpose of the liaison is to further a reciprocal arrangement on information on building code matters in order to advance uniformity and improvement in building laws and regulations not only in New York State but in the other participating states as well.

NEVER Ventilate a Ceiling or Wall Space to the Inside...

If you do, the better the insulation, the worse will be the condensation; for the colder the air in the space between insulation and roof, or walls, the less vapor can it support.

In new construction, thousands of tons of cement and plaster are evaporating. Vapor flows from areas of greater density into this small, cold space, an area of less vapor density and small capacity.

Multiple sheets of accordion aluminum, because impervious to vapor, force out through exterior walls and roofs, ordinary amounts of fortuitous vapor formed from rain leaks, etc. With unusual amounts of vapor, as from crowds, in theatres, schools, stores, etc. provision should also be made to vent this vapor to the *outside.*

In the illustration, an actual case, it was recommended that the inner vents above the insulation be eliminated. More details about this frequent error and other data on vapor flow and condensation sent on request.

Three-sheet accordion aluminum, permanently separated by fiber partitions, is commercially available as Type 6 Infra, and costs less than 9¢ sq. ft., material with labor, installed between wood joists in new construction.

Get valuable FREE copy of new, revised "Simplified Physics of Vapor and Thermal Insulation," authoritative, simply written 44-page manual. Covers heat and vapor flow, condensation, radiant heating, radiation, convection and conduction. Tells how to test insulations yourself and experiment with heat flow. Contains chart of *k*, C, R, and U factors of all insulations, of all thicknesses, weights, densities.

Cold undersurface of roof extracts heat from air, causing condensation of vapor from air in contact.
TYPE 6 INFRA
INNER VENT Incorrect
COLD AIR AREA Can support little vapor
TYPE 4 INFRA
Vapor from newly evaporating structures, and from crowds of people in dried-out structures, flows to areas of less density.
TYPE 6 INFRA
TYPE 4 INFRA
RECTORY
AUDITORIUM

THERMAL FACTORS, TYPE 6 INFRA
Down-Heat C.044, R22.72 equals 7½" DRY Rockwool
Up-Heat C.080, R12.50 equals 4" DRY Rockwool
Wall-Heat C.073, R13.69 equals 4½" DRY Rockwool
VAPOR PERMEABILITY equals ZERO

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10 Murray Street New York, N. Y.
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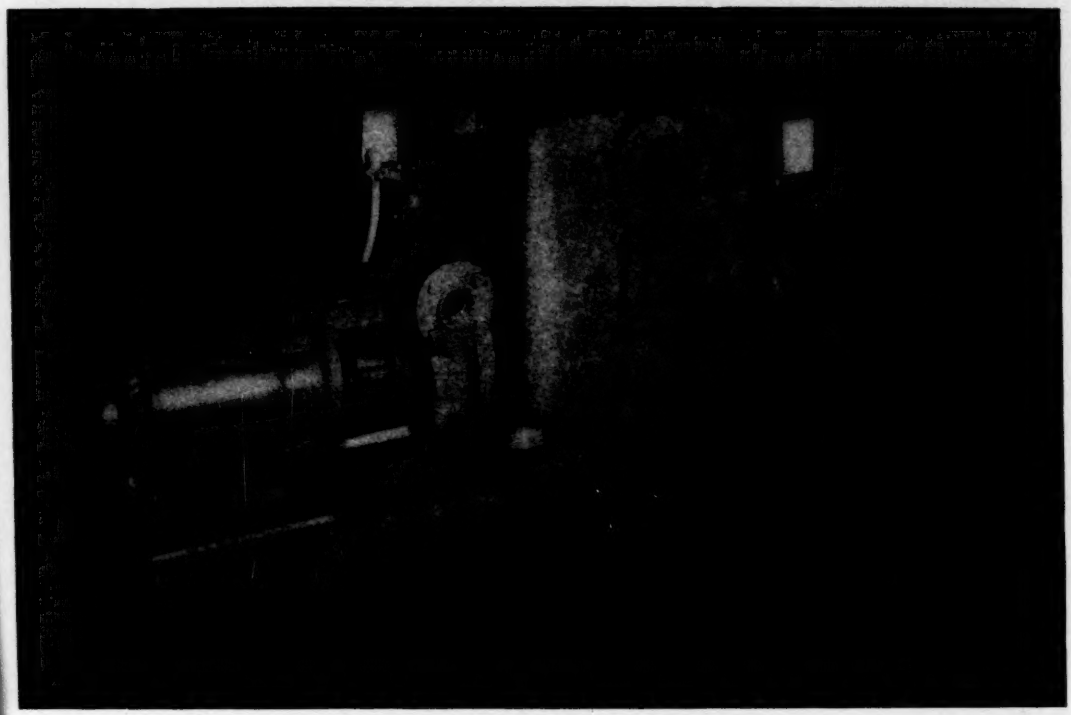

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High Efficiency Collection of RADIOACTIVE DUST

KNOWLTON J. CAPLAN
Mallinckrodt Chemical Works, St. Louis, Mo.

Dust collection in the atomic energy industry presents some new problems. Experience and data are given for some applications involving medium and high grain loadings where the air filter type of equipment would not be suitable. Efficiencies as high as 99.998% at air-to-bag ratios of 27 cfm per sq ft have been achieved using the Hersey reverse-jet principle. Some other types of dust collectors are discussed, but electrostatic precipitation is not considered because the low-voltage type would be unable to handle the loading and the high-voltage type is not competitive in cost. This article is intended to give the results of practical experience at one atomic energy installation rather than to review the problems of the atomic energy industry.

THE widespread handling of large amounts of radioactivity in recent years has created many problems in the field of dust control and dust collection. A considerable amount of research on filter media was conducted, under the cloak of secrecy, during the war years. This research, however, applied mainly to the category of materials known as air filters rather than to the industrial dust collector. Most of the commercially available dust collectors fail to meet, in one respect or another, the very stringent requirements imposed by the collection of radioactive materials.

Requirements for Dust Collectors

One of the major requirements for dust collectors on radioactive service is high efficiency. The extremely low tolerance for amounts and concentrations of stack discharges, the valuable nature of the materials handled, and the fact that many of such materials are accountable in the security sense, combine to make the problem of efficiency important. Fortunately it frequently happens that the more highly radioactive the material handled, the less quantity (by weight) is handled. The required efficiency for most dust collectors on radioactive duty is in the order of 99.99% or better, and is almost always higher than 99.9%.

A second problem confronting the engineer is the question of maintenance. Low maintenance requirements are always desirable, of course, but when the

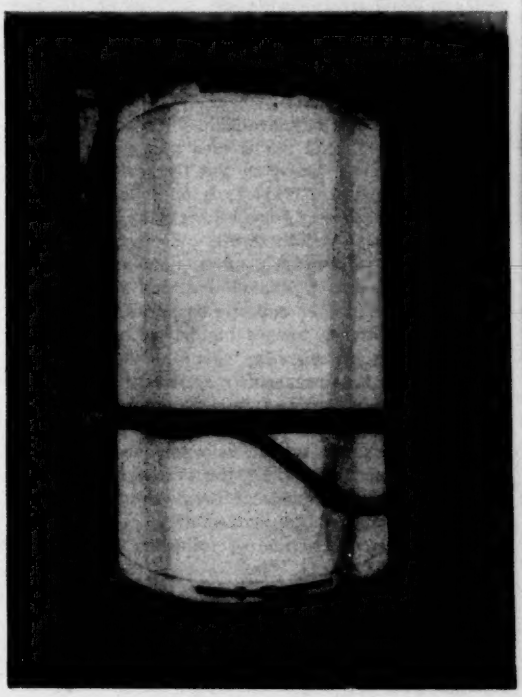

Fig. 1. One type of Hersey reverse-jet filter. Courtesy Pulverizing Machinery Co.

collected material is radioactive the question assumes added importance. The usual protection of personnel by shielding, remote operation, etc., does not apply very well to maintenance of the "hot" equipment itself unless full-remote operation and maintenance are used. Since full-remote installations are tremendous in cost, resort is frequently had to the practice of limiting the time which a worker may spend in a given area.

Maintenance work on or in a dust collector may well fall within this restricted time category. The maintenance man may need protection against dust and/or gas as well as the time protection against external radiation. When it is realized that the operation of changing the bags in a conventional cloth screen dust collector may expend the daily radiation tolerance of twenty or more men, the importance of low frequency, speed, and ease of maintenance is evident.

Also important is the factor of low hold-up of material in the collector, since excessive amounts of material in the collector will increase the amount of radiation and reduce the allowable working time.

The third major problem arises from the fact that it is not permitted to throw away any appreciable amount of radioactivity; neither in the air, in the water, nor on the land. Thus even throwaway filters, if loaded with radioactive dust, would have to be burned in an incinerator which was in turn equipped with some fume-scrubbing device; or disposed of in special burial grounds. This same factor often prohibits the use of wet collectors where they might otherwise be applicable because the contaminated water effluent would require further chemical treatment in order to avoid stream pollution.

It would appear that the radioactivity of the dust in itself has little or no effect on the collection and filtration mechanism per se, at least with materials of rather low specific activity.

Of the commercially available dust collectors, one type which meets the requirements in a fairly satisfactory manner is based on the Hersey principle of reverse-jet cleaning. This type of collector has an efficiency as high as, if not higher than, the conventional cloth bag or cloth screen collector; and avoids the puff of dust commonly experienced after rapping or shaking the conventional cloth screen or bag. Pressure drop through the collector is relatively constant and therefore tends toward better over-all operation of the exhaust system. Bag changing is more rapid, and mechanical maintenance is relatively simple. Material hold-up, in terms of amount of material on the bags, is less primarily because of the smaller area of bag surface. If this type of collector can be operated at an air-to-bag ratio of 20 cfm per sq ft (as it can on most dusts), it is more economical of floor space than the conventional bag collector.

The typical construction of collectors of this type is illustrated in Fig. 1.

Although the illustration shows a single-bag unit, the assembly may be built of multiple bags. Bag diameters range from 8 inches to 36 inches. In the type shown here, the inside of the bag is the dirty side, the dust-laden air entering at the top of the collector. The blow-ring around the outside of the bag travels up and down, guided by guide shoes running on vertical rails. Another model provides a freely suspended blow-ring, suspended from the chains alone, the drive being actuated by a reversing motor to enable direction change.

The blow-ring is supplied with air at about 2 to 3 psig which is discharged through a narrow slot on the internal periphery of the ring, against and through the bag. This reverse-jet of air blows dust out of and off the interior of the bag, resulting in a constant cleaning action. The fact that the internal diameter of the ring is slightly less than the diameter of the bag also creates a small flexing motion in the bag, aiding in the removal of caked or flocculated dust. Fig. 2 will aid in the understanding of this arrangement.

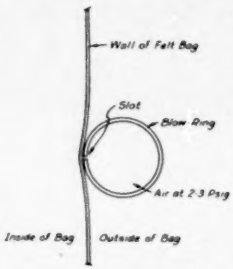

Fig. 2. Cross-section showing blow-ring contact with bag.

Experience to date has failed to reveal any satisfactory filter medium for this type of collector other than a true wool felt. This phenomenon is explained on the basis that woven materials exert their filtering action by first gradually bridging over the space between the fibers with a "filter cake" of the dust being collected; the collected material itself is the true filter. The action of the reverse-jet cleaning air is to continually destroy these bridges between the fibers, and the woven-filter medium continually leaks dust. With the wool felt, on the other hand, dust particles evidently permanently lodge in the larger interstices, and once the medium is primed, the action of the blow-ring establishes an equilibrium condition which makes for constant pressure drop and filtration efficiency.

Some of the most important of the operational characteristics of this dust collector are shown in Fig. 3, 4, and 5. Since it is a well-recognized fact that the operation of any collector is highly dependent upon the nature of the dust collected, these data should not be interpreted in quantitative terms where other dusts are involved. The characteristics shown here, however, are fairly typical for most of the applications of this filter within the author's experience.

One of the most important characteristics is shown in Fig. 3. The dust handled in this case was electric-

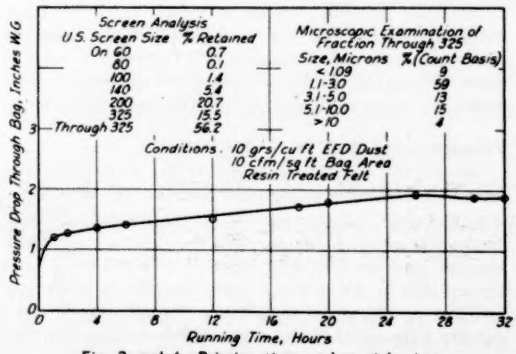

Fig. 3 and 4. Priming time and particle size.

ally fused dolomite and the particle-size analysis is indicated. It will be noted that more than 24 hours of running time were required to establish an equilibrium condition of the felt. In some instances, the time required to reach final equilibrium was as long as 250 hours. The leakage of dust through the collector may be considerable until equilibrium is reached.

Fig. 5 illustrates a typical variation of bag pressure drop with dust loading. The interesting feature is that the curve appears to become asymptotic at extremely high loadings. This phenomenon is probably due to two factors: (a) The dust tends to flocculate in the air at the higher concentrations, and (b) the thicker (and more flocculated) layer of dust on the inside of the bag increases the cleaning action of the blow-ring.

Fig. 6 illustrates the variation of pressure drop through the bag with air velocity. The curve is typical of dusts which seem to cake or flocculate; dry, non-caking dusts give more of a straight-line relationship.

Actual efficiency tests of various collectors are shown in Table 1. Unfortunately, detailed information on particle-size distribution of these dusts cannot be presented, but all are of the nature of fine industrial dusts, having a large fraction in the range of hygienic significance in the small micron sizes.

TABLE 1—EFFICIENCY TESTS OF VARIOUS COLLECTORS

Type Collector	Air-to-Bag ratio, cfm per sq ft	Bag Pressure Drop, in. w.g.	Loading, grs per cu ft	Effluent, grs per 1000 cu ft	Efficiency, %
1. Conventional cloth screen collector*	1.67	5.5	1.0	0.480	99.952
2. Reverse-jet felt same dust as No. 1	27.7	6.5	32.4	0.411	99.998
3. Reverse-jet felt	21.4	3.5	0.07	0.0378	99.946
4. Reverse-jet felt (pneumatic conveyor after-cleaner)	15.9	4 — 10	14.0	1.08	99.992
5. Porous carbon ¾-inch thick	10.8	6 — 12	8.6	0.0468	99.9995

*The bags were well loaded and not rapped during the period of test.

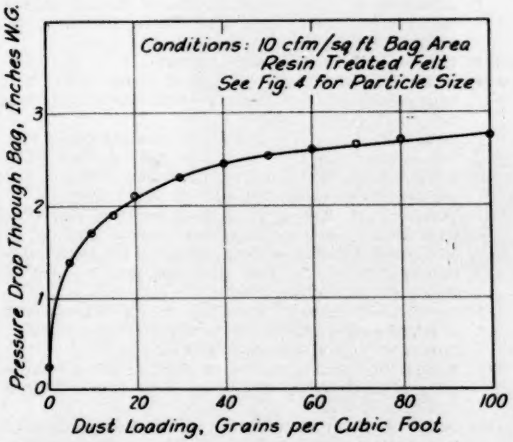

Fig. 5. Pressure drop vs. grain loading.

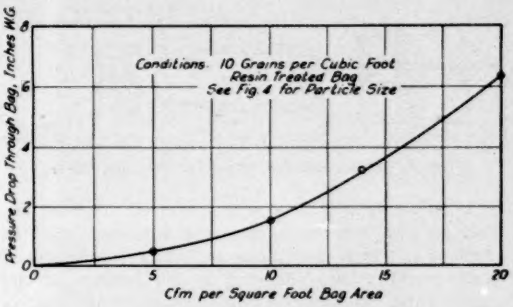

Fig. 6. Pressure drop vs. air flow.

It will be of interest to point out that Collector No. 1 was replaced by Collector No. 2 on the same duty. The volume handled by the dust control system was more than doubled, with an increased use of floor-space for the dust collector of about 50%. The changing of bags on Unit No. 1 expended the daily radiation tolerance of twenty men, while the same job may be done by two men on Collector No. 2.

Collector No. 4 is used as a final cleaner on a pneumatic conveyor system, and represents the highest effluent concentration from this type of collector in the author's experience. The high discharge concentration is possibly caused by the frequent excessive bag pressures of 10 inches w.g., with subsequent distortion and straining of the felt fibers, in combination with the high grain loading. It will be noted that Unit No. 2 has a lower effluent concentration even though the dust loading and filter ratio are both higher.

Collector No. 5 is shown merely for purposes of comparison. This filter consists of a heavy housing supporting a porous carbon cylinder with ¾-inch walls. The maximum pore size of the carbon is stated to be five microns. This collector is used only a in very small sizes on small process gas streams and would be extremely difficult to use as a dust collector in the usual industrial sense. These data are presented merely for comparison purposes as a nearly absolute filter.

In field application, the absolute amount of material discharged from a ventilation stack is the item of primary interest for both atmospheric pollution and material accountability reasons. Most of the effort expended in the testing of collectors is therefore devoted to the measurement of the contaminant concentration in the discharge stack.

Many papers have been written developing the theory of sampling high-velocity gas streams for particulate matter (1, 2, 3, 4, 5, 6, 7, 8). The main conclusion of these discussions is that the sample should be extracted from the duct through a sharp-edged nozzle pointing upstream, and that the sampling velocity should match the duct velocity. Accordingly, an

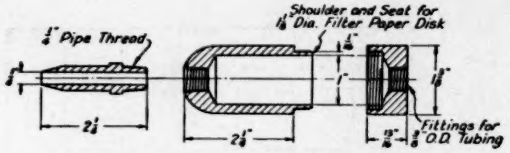

Fig. 7. Cross-section of iso-kinetic sampling head.

iso-kinetic sampling head was developed in which the filter medium was incorporated in the head itself in order to minimize any losses in sample by reason of small dust particles adhering to the interior of the sample tube. A sketch of the sampling head itself is shown in Fig. 7.

The head is mounted on the end of a ⅜-inch OD brass tube shaped like a pitot tube. A 3-inch capped pipe nipple (close nipple) welded to the stack at a suitable location provides a satisfactory sample port through which this head may be inserted.

A metered volume of air is drawn through the sampler by means of a small air pump. The volume rate of the sample is adjusted so that the velocity at the sample nozzle will be substantially equal to the duct velocity as determined by pitot-tube traverse. A set of four or five interchangeable nozzles with various internal diameters, plus a possible variation in sampling rate between 0.2 and 1.0 cfm, enables a wide range of duct velocities to be covered.

Since collectors on this duty are usually provided with stacks tall enough to get above the roof-lines in the vicinity, it is no problem to find a suitable sampling location in a section of straight duct 7.5 diameters or more downstream from the nearest elbow or other obstruction.

The filter medium commonly used is a 1⅛-inch diameter Whatman No. 41 paper. The amount of material collected is determined either by suitable counting techniques described in the literature or by chemical analysis (9, 10, 11).

In spite of the fairly voluminous literature describing the proper techniques for duct sampling, it is with surprising frequency that one encounters reports of such tests made with standard industrial hygiene equipment originally designed for taking samples of room air. The magnitude of the errors introduced by the use of such unsuitable techniques may be considerable and theoretically would be influenced by the velocity of the air stream, the size and shape of the particulate matter being sampled, and the configuration of the sampling head being used. Accordingly, a few tests have been made here in order to demonstrate the presence of such errors. The results are shown in Table 2.

TABLE 2—COMPARISON OF ISO-KINETIC vs REGULAR SAMPLE

Test No.	Type of Sampling Head			Duct Velocity
	Iso-Kinetic	Regular	Ratio Iso-Kinetic / Regular	
1 (10 samples)	1.08	0.607	1.78	1400 fpm
2 (5 samples)	9.18	1.09	8.40	2900 fpm

The samples shown in the column headed "Regular" were taken with a head usually used for taking samples of room air. The sample head is essentially the same as the rear portion of the iso-kinetic head previously shown, except that it has a face opening of one inch inside diameter rather than a restricted nozzle. Air velocities at the face of the sample opening are usually in the order of 100 fpm. For these tests, the regular sample head was held at the same location as the iso-kinetic head but at right angles to the direction of the air stream. Errors of a similar type will be introduced with other types of standard industrial hygiene equipment, such as the electro-static precipitator or the Greenburgh-Smith impinger.

In the data reported concerning efficiency of dust collectors, no attempt was made to sample the "dirty" side of the collector because adequate sampling equipment was not available and for other technicological reasons. The equipment previously described is not adequate for sampling streams containing large amounts of dust, primarily because the filter plugs too rapidly. Efficiency calculations were made on a weight basis by the following procedure:

(1) The effluent stream was sampled continuously for a period of several hours or more to integrate changes caused by variation in dust load on the system.
(2) The amount of material collected by the dust collector during the test period was weighed.
(3) The percentage of material passing the dust collector was calculated. Efficiency calculations were made by subtracting the percent passed from one hundred.

The author wishes to express thanks for the assistance of Mr. D. J. Huelster of Mallinckrodt Chemical Works in gathering some of the data and to the Pulverizing Machinery Company for furnishing additional information.

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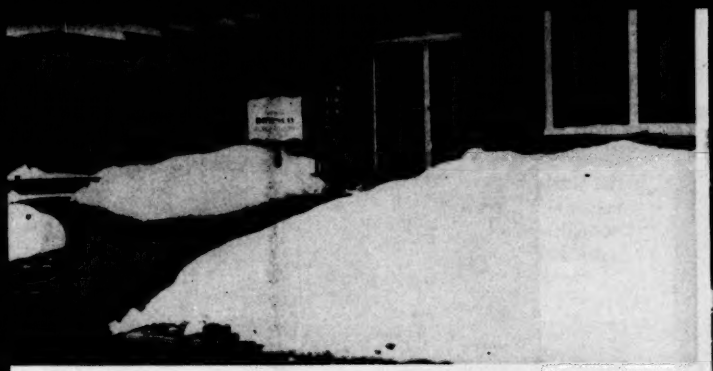
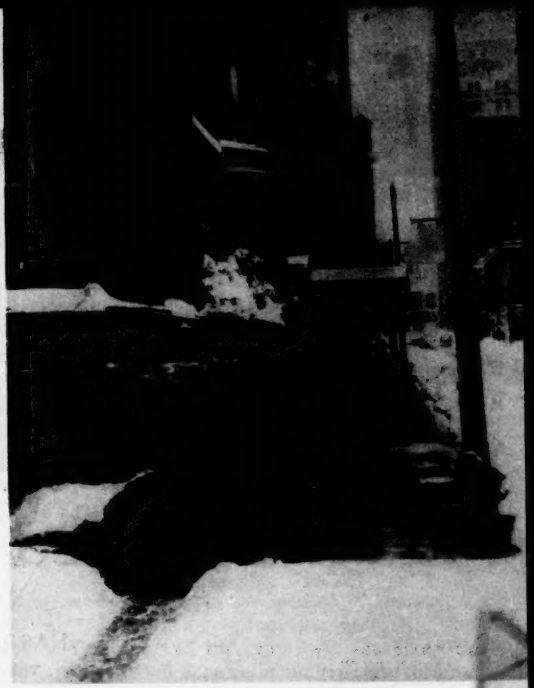


When Pittsburgh's greatest snowfall descended on the hilly Mt. Washington area, vehicular traffic almost stopped and pedestrians traveled at their own risk. Funeral director Albert J. Brusco was prepared with a newly-installed snow-melting system, consisting of wrought iron pipes which carry hot water under his entryways and sidewalk, keeping them free of snow and ice at all times.



In 1948 Pittsburgh's famed Duquesne Club replaced its front sidewalk. Before the new slab was laid, prefabricated grids of one-inch pipe were set in place and welded together. The system kept the new sidewalk clear and passable all through the greatest storm in Pittsburgh's history. Note dry condition of walk while shoveled walk in background has film of ice.

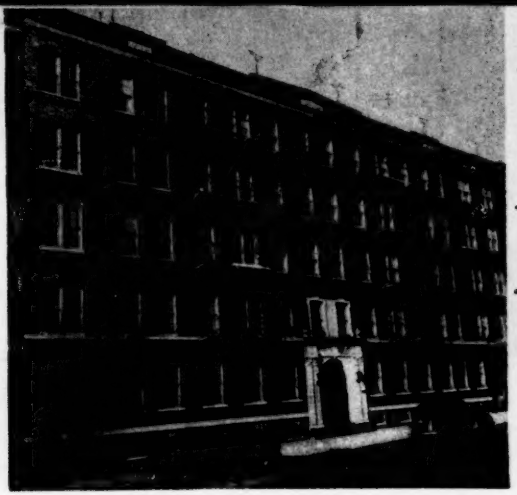
Pittsburgh Melts Record Snowfall

Snow-Melting Systems Keep up with 31-Inch December Storm

(Left) A snow-melting system installed in 1949 under the sidewalk in front of Pittsburgh's Union National Bank paid handsome dividends in the recent big snow. Note snow barrier at curb of shoveled walk in foreground.

(Below) At a time when thousands of pitched driveways in Pittsburgh were blocked by a record-breaking 31-inch snow, this one remained clear. The scene is at the home of a physician, Dr. Ralph G. Fabian.

All photos courtesy A. M. Byers Co.



(Right) Apartment house in New York where installation of stoker was made.

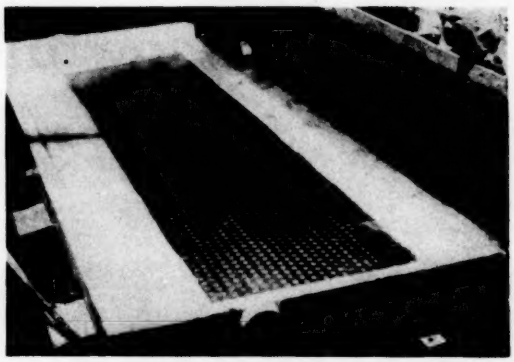
Tailoring an Anthracite Boiler to an Overfeed Rice Stoker

HARRY F. EASTWOOD
Fuel Engineer, The Philadelphia and Reading Coal and Iron Company

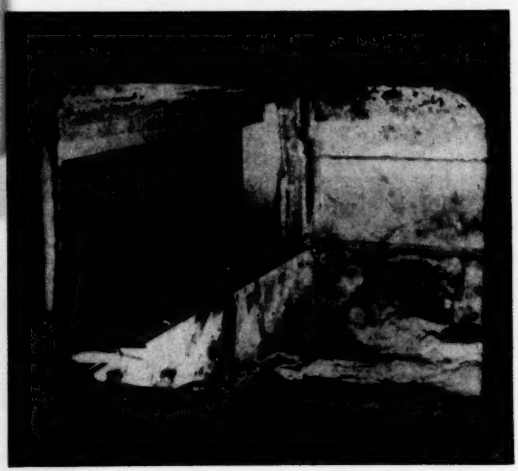
AN unusual operation was recently performed on a large firebox heating boiler in a New York apartment house to adapt the boiler to a rice anthracite-burning stoker. The operation involved cutting a large "window" through the side of the firebox.

Since it has become common practice to replace the boiler mud ring by cutting out a badly corroded base with an acetylene torch and electrically welding in a new one, there is no practical reason for not taking advantage of the height and convenience of such an opening (which ranges from eight to eighteen inches in height) to install an anthracite stoker.

Such a change was effected in the heating boiler in a 48-family apartment house which prior to the conversion burned 214 tons of No. 1 buckwheat anthracite. A Losch water-cooled grate, 72 inches long and 28½ inches wide, was inserted through the left side of the firebox. It is suspended on four floating links attached by short brackets welded to the left side of the firebox. The grate slopes downward toward the center of the firebox at an angle of approximately 7 deg. An air gallery covers the lower side of this grate connected by flexible coupling to twin squirrel cage fans, 2,000 cfm capacity, driven by a ¾ hp motor. The air openings in the grate are approximately 9/64 inch and are spaced ¾ inch apart over the fuel burning area. The top and bottom ¼ inch steel plates of water-cooled grate are drilled oversize to correspond with this spacing, and brass ferrules are pressed into these openings until they are water-tight. Then, the air holes are drilled through their centers. Some of these



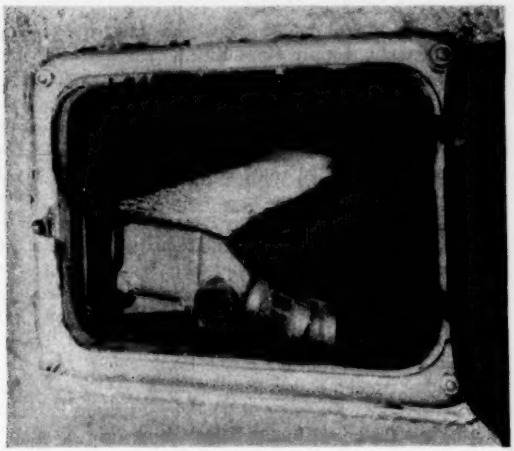
Grate area showing the 9/64-inch holes spaced ¾ inch apart.



Cut in side of firebox after welding but before mounting the grate and hopper.

ferrules also function as staybolts, since this equipment is tested to 65 pounds hydrostatic pressure.

Rice coal is fed by gravity to the suspended grate from a one-ton capacity hopper attached to the left side of this boiler. The motion that causes this stoker to function is reported to be the minimum mechanical movement ever utilized to move fuel, fire, and ashes simultaneously and progressively across the grate.



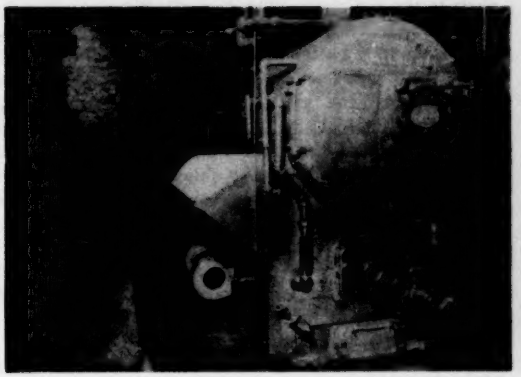
The grate in operation at a maximum burning rate. To the left, the green coal from the hopper, to the right the ash just before dropping to the pit.

Grate Movement

The grate, being hung like a pendulum from the four corners by the links suspended from brackets welded to the boiler, is moved ¼ inch to ⅜ inch back toward the hopper side of boiler by a small reduction gear operated by the fan motor. There is an adjustable cam release built into the reduction gear that operates much like a trigger or trip to release the grate to swing back to find its equilibrium. Two studs attached to opposite ends of the rear of the grate equipped with nut and washer and lock-nut arrest the grate swing against heavy spiral springs secured to the stoker frame below the hopper. This sudden checking of the forward motion of the grate causes the coal, fire, and ashes to progress across the grate to the ash discharge in the pit.

The means of connecting this water-cooled grate to the boiler water is unique and has been adopted after many years of development by the manufacturer. An appreciable increase in friction to the pendulum swing of the grate would probably prevent effective stokering or complicate timing adjustments. Four damper control type 85-15 bronze bellows, 2 in. in diameter and 12 in. in length, are connected into the boiler above and perpendicular to the grate connection, one located at each end of the grate at the bottom or low point where water enters the grate and the other two at either end of the high point of the grate where the water re-enters the boiler. Two bellows are used on smaller adaptations.

The secret of reducing the friction to the minimum in the grate movement and retaining water-tight flexible pipe connections is in the method of connecting these long bellows in a perpendicular position. The pendulum-like swing of the grate over the ¼ to ⅜ inch arc finds little resistance in the multiple folds of the bellows and little or no fatigue is suffered by the metal due to its wide distribution.



Coal hopper for the stoker, with the twin fans and reduction gear box below. The flexible piping connections to the grate at the rear of the boiler are in the foreground. Similar connections are located at the front.

By means of the external piping from the water legs to the grate and thence to the upper portion of the cylindrical section of the boiler, internal circulation was accelerated, and the heat transfer to the hot water submerged coil was improved so that summer operation of the stoker will be reduced.

There are ten different rates of coal feed to the grate from the hopper, determined by the position of the side arm control lever attached to the reduction gear box. This results in flexibility in setting the coal feed for the average fuel rate required in a given building, with resulting economy.

Automatic heating control is obtained by using an outdoor thermostat in conjunction with a program clock to supply steam pressure at predetermined pe-

Program clock for controlling the operation of the stoker is at right, motor starter at bottom and switch at left.

riods to the radiators. The domestic hot water supply temperature control and ignition maintenance is incorporated in the same instrument and wiring hook-up.

An effort was made to select a type of heat control that required the minimum of manual adjustment. When the most satisfactory length of operating cycle has been selected, the outdoor thermostat reduces this operation to the minimum by skipping as many of the operating cycles as weather conditions permit. The ignition timing control of one five-minute operation every three hours is not affected by exterior temperatures as a separate dial on the same shaft controls this function. The automatic start in the morning and night shutdown at any predetermined hour are controlled by the first dial.

Upon completion of the installation in mid-November, 1950, of the Losch conversion stoker, cold water was fed to the boiler and all welds checked for leaks. After being placed in continuous operation, the normal time to raise steam has been found to be from three to seven minutes, burning coal at the rate of four pounds per minute. The ash indicates very little unburned carbon.

During some cold weather in January a recording thermometer showed that the temperature of one of the most exposed apartments on the top floor was well above 70F during the day and never below 67F at night shutdown period. A seven-day continuous record was made after suitable air valves had been installed on radiators in this apartment. This test indicated excessive heating and that it would be advantageous to lengthen the time cycle between stoker operations to avoid the waste of forcing steam into a system before a reasonable amount of condensation had taken place.

The theory of this is to obtain the full heat value of the steam before more is added. Cast iron radiators usually stay warm enough to act as a balance wheel between short steam cycles.

A check on the amount of coal consumed for heating and hot water supply since the installation was completed November 10, 1950 until January 10, 1951, showed an average of one ton per day.

While no accurate month by month record had been kept over the two preceding years, the fuel bills for that period indicated that at least 214 tons of No. 1 buckwheat had been used, and during both of these years the number of degree-days was about 20% below normal. Therefore, calculations indicate that the stoker is now burning about the same tonnage as before under a current 18.8% larger heating load as reflected by the degree-days; or, putting it another way, 15.8% less tonnage is being burned per degree-day, and the fuel burned is the lower-priced rice.

The apartment house, located at 1151 Elder Ave., Bronx, New York, is owned by Price-Lipman. Installation was by Losch Boiler Sales Co. of New York.

Cooling Equipment Installed in Giant Supermarket

Serving the people of Greater St. Louis, Bettendorf's, in Clayton, Mo., combines many striking new advances in supermarket design and function. Under construction for almost a year, it covers more than 34,000 sq ft of floor space, and has been acclaimed one of the most modern supermarkets in America.

To meet varied cooling needs in this "supermarket of the future," Marlo equipment is used extensively. The gigantic shopping area is served by two 28-ton Marlo floor-type air conditioning units, each with 17,150 cfm fans. One of these units is also equipped with heating coils.

The vegetable and meat processing rooms are served, respectively, by a C-750 ceiling-type and a F-1125 floor-type air conditioning unit. In the frozen food cooler, temperature is held at —5F by a LT-184 low temperature unit with automatic electric defrost.

Ceiling-type Marlo air conditioning unit serving the vegetable processing room where produce is trimmed and prepared for display.

Exterior view of new Bettendorf supermarket in Clayton, Missouri.

Fundamentals of Schoolroom Heating and Ventilating

HENRY WRIGHT
Consultant, Herman Nelson Division, American Air Filter Co., Inc.

The importance of cooling or ventilating to achieve winter comfort in schools is discussed. Heating and ventilating systems are described.

SCHOOLROOM heating and ventilating presents a unique problem, similar in some ways to the ventilation of crowded spaces like assembly halls and theaters, and in other ways to the heating of the so-called solar house with its large glass areas and solar heat gain. In other ways, schoolroom heating and ventilating differs radically from most other comfort conditioning problems.

Because of their part-time use, it is inevitable that classroom heating systems are operated on an intermittent basis. The heating equipment is used primarily to warm the room for occupancy in the morning, rather than to maintain comfort conditions on a steady heat-flow basis. From the heating point of view alone, the definition of a satisfactory schoolroom heating system is more a matter of its ability to warm the room to the comfort point in a relatively short time (1-3 hours) under all weather conditions, than a matter of its ability to overcome the steady heat loss at a minimum outdoor temperature.

Ideally, the design of such a system should be based on the heat capacity of the structure and contents of the room, the amount the building is to be allowed to cool over holiday weekends, and the maximum tolerable warming-up period, as well as on its steady heat-flow characteristics at the minimum design temperature.

In practice, the typical classroom may require up to 3 times as much heat for warming the required minimum quantity of ventilating air as is needed to overcome the heat loss through the walls and windows, and this provides the excess capacity needed for quickly warming the room at the beginning of the day. Since ventilation of the room need not begin until after it is occupied, this excess capacity can be utilized to raise rapidly the room temperature by supplying heat at 2 to 3 times the rate at which it is escaping from the room, even in coldest weather.

Once the schoolroom is occupied, its steady heat loss is increased 2 to 5 times by the ventilating load. Thus a typical one-exposure classroom may have a steady heat loss, through the wall and window, of about 12,000 Btu per hour at 0F. The ventilating load, figured at a minimum rate of 10 cfm per pupil (some states require 30 cfm), will be about 24,000 Btu. On the other hand, the heat given off by the pupils and others, may be as much as 7,500 Btu per hour. Relative to the total heat loss of 36,000 Btu at 0F, this gain is not very significant. In winter weather of 40 to 50F, however, when the heat loss goes down to some 15,000 or 10,000 Btu, it is very important. With no other source of heat gain, the gain from the schoolroom occupants, under the conditions outlined, will completely balance the heat loss at about 55F outdoor temperature, figuring the usual 15 mph wind.

The average up-to-date classroom lighting system, even when fluorescent lamps are used, generates from 3,000 to 4,000 Btu per hour. Solar heat gain, with the type of continuous windows now being used in most new schools, may total from 35,000 to 50,000 Btu per hour, or enough to more than balance the heat loss even at 0F.

Cooling for Winter Comfort

Thus the school classroom presents the paradoxical requirement of a positive need for winter cooling. In fact, with average use, the schoolroom being built today is much more likely to require cooling than it is to require heating, except during the first hour or two of the school day when heat is needed to bring it up to temperature. This peculiarity it shares with the solar house, but in greater degree, for the typical schoolroom ordinarily has more glass area per square foot of floor than the most extreme examples of solar house design. Use of larger windows has merely accentuated a problem which already existed.

By cooling is meant the introduction of outdoor air, over and above that needed to control odors, and to prevent an undue rise in humidity, to avoid overheating of the room due to internal heat gain. Such cooling, according to present practice, is accomplished by ventilation but the cooling might be achieved in other ways.

If the typical classroom were completely unventilated for an indefinite period, the worst that would happen would be that it would acquire an unpleasant odor, and in cold weather a great deal of moisture would condense on the windows. Also—a very big also—if there were no means for cooling the room it would probably become overheated, except in extremely cold weather. Thus the "thermal" theory, which states that the need for outdoor ventilating air, over and above the minimum needed to control body odors and excess humidity, is in proportion to the need for cooling due to heat gain from various sources.

Heating Systems

Four principal means for heating and ventilating school classrooms have been used:

(1) *Central Fan System.* The principal heat source, outdoor air intake, and circulating fans are located at a central point serving the entire building or an entire zone. Additional radiation may be placed in the classrooms for supplementary heating. Central fan systems are rarely used today because of the difficulty of maintaining a proper balance between the various rooms under differing weather and occupancy conditions.

(2) *Radiation with Window Ventilation.* The classroom has radiators, sometimes with thermostatic controls. The supply of outdoor air is regulated by opening and closing the windows; air is exhausted through gravity vents or by mechanical exhaust fans and ducts. It is still much used despite the difficulty of maintaining stable temperatures with manual control of ventilation.

(3) *Unit Ventilation.* Unit ventilators, located on the outside wall of the classroom, draw outdoor air (through an opening in the wall in back of the unit), room air, or a mixture of both through a concealed convector. This air is discharged vertically towards the ceiling at high velocity. An interlocking control, manual or thermostatic, regulates the supply of steam or hot water to the convector and a mixing damper at the bottom of the unit which determines proportions of room and outdoor air handled. The units are usually set to admit the legal minimum of outdoor air at all times, except during the warming-up period when the classroom is unoccupied, and additional air as needed to prevent the room temperature from rising above the control point. Unit ventilation is justifiably popular as the only system of room-by-room control capable of automatically cooling the room as well as heating it. In some localities, classrooms equipped with unit ventilators normally have supplementary convectors to aid in quickly warming the room in the morning and in keeping it warm during extremely cold weather. The tendency, however, is away from the use of such supplementary radiation, and towards the use of unit ventilators sized to do the whole job.

(4) *Panel Heating.* A number of schools have heating panels, usually in the classroom floors, in kindergarten and first grade classrooms. Where such systems employ window ventilation, the high heat capacity of the heating panels makes it difficult to prevent overheating after the rooms are occupied, since floor panels require several hours to cool to room temperature. For the same reason, heating of the room after a weekend shutdown must begin much earlier than with other systems. For these reasons, such panels should probably be employed only to supplement a unit ventilator, or other responsive heat source. In any event, some form of automatic mechanical ventilation should be provided to prevent overheating.

Fans versus Windows

There is still a substantial body of opinion, notably in the State of New York, which holds that windows equipped with draft deflectors, in conjunction with gravity exhaust vents and direct sources of heat, such as radiators, is all that is needed for the satisfactory heating and ventilating of the average classroom. The reasoning behind this opinion is:

(1) Since there will be no physiologically-harmful results, even if the classroom is completely unventilated, there is no need for a positive source of outdoor air.

(2) Since the principal harmful result of lack of ventilation is overheating of the room, occupants can shut off the heat and/or open the windows for their own comfort.

(3) It has been demonstrated that thoroughly satisfactory results can be obtained with such a system, with the exercise of intelligent care and attention.

However, the following three arguments are also pertinent:

(1) School classrooms always require some ventilation, and sometimes require excess ventilation for cooling when outdoor temperatures are such as to discourage opening of the windows because of resulting drafts.

(2) Occupants of a room are poor judges of its ventilation requirements. They are unconscious of the gradual formation of odors. They become aware of overheating only after it has had its ill-effects on mental alertness and psysiological processes.

(3) Thermostatic control, the only means of maintaining optimum thermal conditions at all times, is effective in the school classroom only when a means is available, under the control of the thermostat, for cooling the room. Window ventilation was advocated by the New York State Commission on Ventilation, which did pioneer and extremely valuable work in rationalizing school ventilating practice, setting aside excessive ventilation requirements based on erroneous conceptions of ventilating needs. The Commission, however, is in the position of having thrown out the baby with the bath water. Because mechanical ventilation at the rate of 30 cfm per occupant regardless of weather conditions represented a large and unnecessary waste of fuel, it concluded that mechanical ventilation itself was to be avoided, the substitute being "intelligent care and attention" to open-window ventilation.

Ventilating Capacity

While some state codes still require 30 cfm of outdoor air per occupant as the minimum ventilation rate, many others have reduced this requirement to 10 cfm, or eliminated it altogether. This should not be taken to mean, however, that 10 cfm per occupant will be adequate for cooling purposes, when cooling is needed. Here the older figure of 30 cfm is, if anything, barely sufficient, especially in the modern classroom with its huge solar gain. Some classrooms are now being built with fixed windows, and with complete reliance placed on mechanical ventilation. In such cases, and particularly when the classroom faces West and has no window overhang, awning or other means for excluding solar heat, 30 to 35 cfm of outdoor air may prove totally inadequate to balance the solar heat gain in mild weather. Either the window or its means of pro-

tection must be redesigned or provision made for admitting a much larger quantity of outdoor air.

Exhaust Vents

School heating and ventilating practice—which to a considerable extent "just growed" through its various stages of central fan systems, split systems, unit ventilation, and open window ventilation—has always involved an undue preoccupation with exhaust vents. In the days of the central fan systems this made some sense, since the only way of achieving fairly good ventilating air distribution in such systems was by locating the exhaust opening in the proper relationship to the inlet. This completed a circuit which the air could more or less be depended upon to follow. Location of the exhaust vent in these early systems was also influenced by a belief that the "noxious" air, supposed to be present in the room, would settle. This notion has given rise to the requirement, still embodied in some codes, that exhaust openings be placed not more than so many inches above the floor.

With the widespread substitution of high-velocity, vertical-discharge unit ventilators for central fan systems, the critical nature of the location of the exhaust vent disappeared, and, with it, any real need for the exhaust vent itself. Unit ventilators can force the air out through the cracks around windows.

Meanwhile, practices have grown up around the exhaust vent requirement: Venting through cloak rooms and lockers, mechanical exhausts and corridor exhausts. Since in many cases provision of some type of exhaust was a legal requirement, such arrangements continued to be used, despite the fact that exhaust vents are unnecessary and a source of trouble, and may cause short circuiting of the ventilation from the windward to the leeward side of the building.

A radically new type of exhaust, known as the Draft Stop system of ventilation, has been introduced by the company with which the writer is affiliated. Air is exhausted (and also drawn into the unit ventilator for recirculation) through a continuous slot immediately beneath the classroom window. This has the advantage of drawing off air chilled by the window glass before it can re-enter the room, thus eliminating window downdrafts, regardless of whether the heating demand is negative or positive. This system has thus restored the exhaust vent to its old position where it plays a part in controlling the air circulation in the room by creating a general movement of room air from the warm to the cold side of the room, which is desirable because of the large window areas now used in most schools.

Panel Cooling

This development calls attention to the fact that the modern schoolroom possesses the largest and coldest "cooling panel" encountered in present practice—the classroom window. It is not unusual for classroom windows to be as large as 250 sq ft. In zero weather, the surface temperature of the side of the glass facing the room frequently falls below 25F. This has a marked effect on the heating of the room, since, in addition to the downdraft mentioned, the window also exerts a radiant cooling effect on the entire room. It is especially pronounced for the occupants closest to the window.

Calculations indicate that this radiant cooling effect may lower the operative temperature of such a classroom by as much as 10F, so far as the center of the room is concerned, and even more for occupants near the window. This is true almost regardless of the method of heating employed, and regardless of the means employed for controlling the window downdraft.

The radiant-cooling effect of large classroom windows might, of course, be minimized by double glazing, and this is what has been done for a long time in the northernmost states, where it has been the practice to use storm windows in school buildings to minimize the effects of extreme weather. Since classrooms are heated such a small part of the time, such precautions do not have the same economic justification as a matter of fuel saving, as is true of other types of buildings. Double glazing also presents a special maintenance problem in school buildings, where glass breakage is unusually high.

An exception to this is the use of glass block, now very popular in school construction. Glass blocks provide substantially the same insulation as double glazing, and, as used in school buildings, they have the additional advantage of providing a desirable means of controlling the natural lighting. They are only a partial corrective for the downdraft and radiant-cooling problem created by continuous windows, however, since they are used only in the upper part of the opening, in order to provide outlook at eye level.

New Standards of Performance

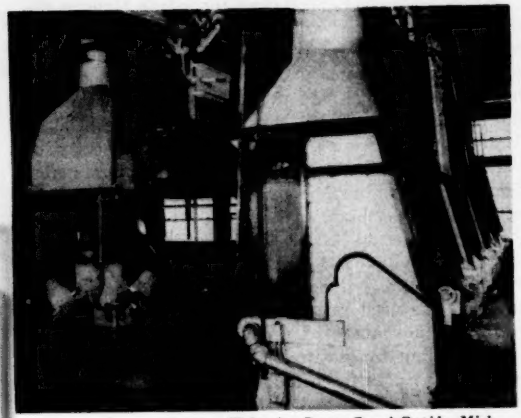
Mention of the still unsolved radiant-cooling problem in classrooms calls attention to the need for a re-evaluation of standards of heating and ventilating performance in the school field. In recent years, the advances made in school lighting, acoustics, planning and equipment have been enormous. Progress in schoolroom heating and ventilating has been less spectacular. The time has come for the industry to review its approach to classroom conditioning in an effort to discover what positive educational contribution, if any, it can make.

Physical discomfort, resulting from uneven heating, contributes to restlessness and postural distortion which interferes with learning. Moreover, it has been shown that mental alertness and tendencies toward errors and accidents are a function of the thermal environment, and that there is an optimum environment for every type of activity which is most conducive to optimum performance. It is up to the heating and ventilating industry to determine, by research and experimentation, just how significant an effect good comfort conditions have on the educational process, just as has been done by the lighting industry in its field. Once this correlation has been established, every effort must be made to solve in the most economical way possible the problems revealed by such research. There is no reason why the next 20 years should not show the same improvement in classroom conditioning as has been made in the last 20 years. All divisions of the industry will benefit if this goal is achieved.

Scrapbook of Exhaust Hood Design

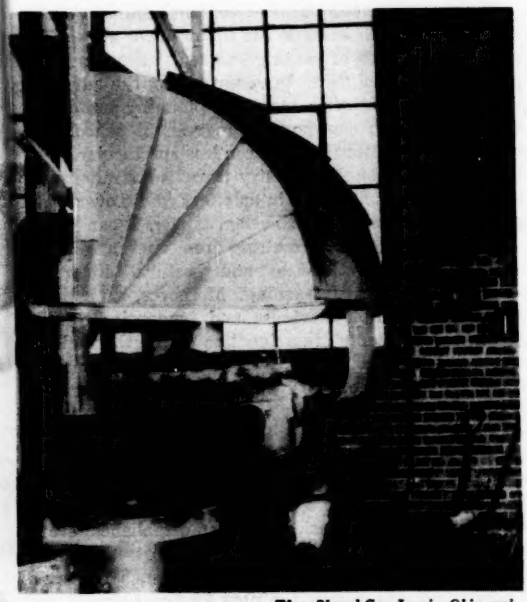
Part 8—Ventilation for Melting Furnaces

JOHN M. KANE
Chief Engineer, Dust Control Division, American Air Filter Co., Louisville, Ky.



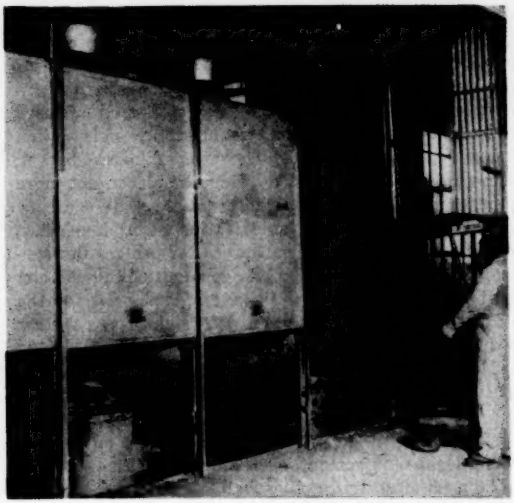
Wolverine Brass, Grand Rapids, Mich.

Fig. 1. Ten tilting furnaces in this melting room are provided with complete exhaust enclosures. Furnaces are oil fired, 600 lb capacity with No. 225 crucibles.



Thew Shovel Co., Lorain, Ohio, and Ohio Industrial Comm., Div. of Safety & Hygiene

Fig. 2. Cantilever hood, which can be manually pushed back as required to prevent interference, gives good control.



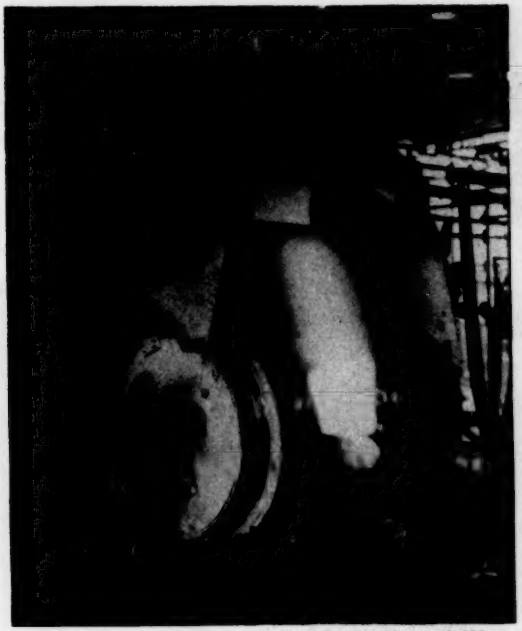
Thew Shovel Co., Lorain, Ohio, and Ohio Industrial Comm., Div. of Safety & Hygiene

Fig. 3. Each 200 lb, No. 70 crucible pit furnace has its own complete enclosure. Combustion gases and fumes are exhausted by indraft maintained between front panel and floor.

EXHAUST ventilation designs for melting furnaces will vary with the metal melted, the type of furnace, and the need for collection equipment. In the melting of non-ferrous metals, the crucible furnace, tilting or pit type, and the rocker or barrel type are most frequently encountered.

The exhaust hood for the tilting crucible furnace has often followed a simple flared overhead hood design. Natural or mechanical draft is employed and exhaust volumes in the order of 4,000 to 6,000 cfm per furnace is indicated. Hoods of this type require relatively large exhaust volumes, are subject to disruption of control from cross drafts, and are a considerable distance from fume generation during pouring. They do, however, provide for minimum interference to the charging operation and to tilting of the furnace for pouring.

Several companies have demonstrated that more effective enclosures are often possible. In cases like those illustrated in Fig. 1, exhaust volume may be reduced to approximately 2,500 cfm per furnace as the hood approaches a complete enclosure type with an access door in the hood rear for charging and a counterweighted front panel that can be raised for pouring.



Power Valve Co., Cincinnati, Ohio, and Kirk & Blum Mfg. Co.

Fig. 4. This modified canopy hood approaches a booth type enclosure with the back drop and side shields that have been incorporated in its design.

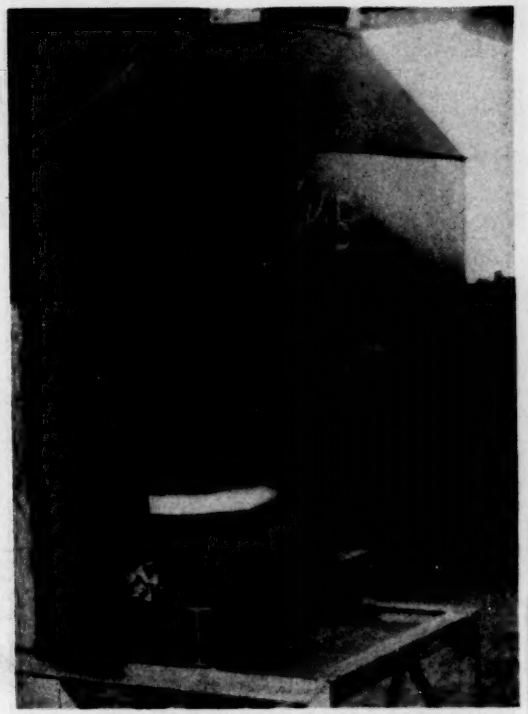
The cantilever hood, Fig. 2, offers another solution for this type of furnace.

In the pit type, access must be available to permit removal of the crucible. The hood detail illustrated in Fig. 3 is one effective method of providing control. Exhaust volumes per furnace will be in the order of 2,000 cfm, sufficient to maintain as indraft of 100 fpm through all the openings when the access doors are open.

Control of the rocker type of furnace, as shown in

Westinghouse Air Brake Co., Wilmerding, Pa., and Kinhlman Electric Co., Bay City, Mich.

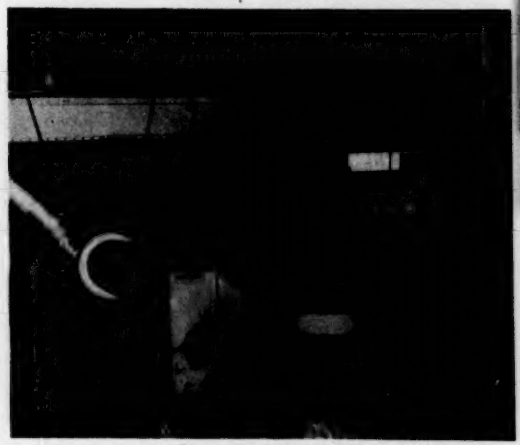
Fig. 5. Access door in rear of hood permits charging this 70 lb electric rocker furnace.



Detroit Bureau of Industrial Hygiene, Detroit, Mich.

Fig. 6. Hooding for this ladle heater is designed to maintain indraft velocities of 300 fpm to counteract rebound from the gas flame; a total of approximately 2,000 cfm is exhausted from each station.

Fig. 4, is quite simple and effective during its melting cycle. A more complete enclosure will provide better control during the pouring operation. Front side of hood is hinged to provide access to the furnace, while hinged doors in the back, Fig. 5, are used for charging.



Locomotive Finished Material, Atchison, Kans.

Fig. 7. Local exhaust hood installed on roof ring of steel foundry electric melting furnace.

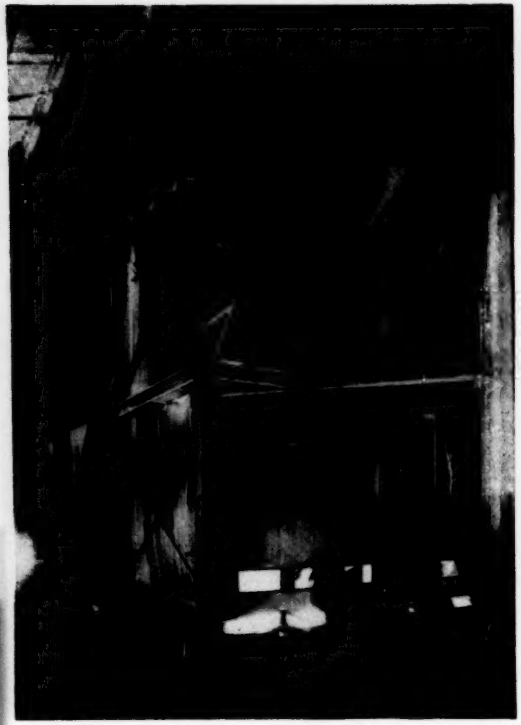
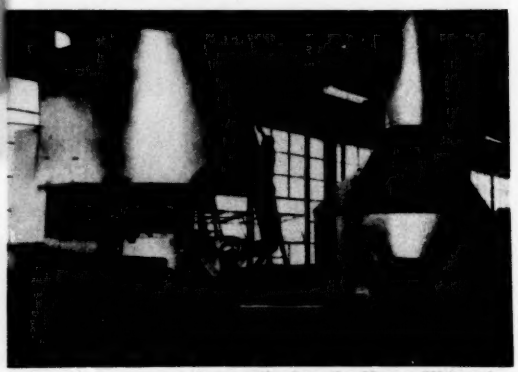


Fig. 8. To hood this carbide furnace, a room type of enclosure was required, in addition to the mechanical charging of the feed.

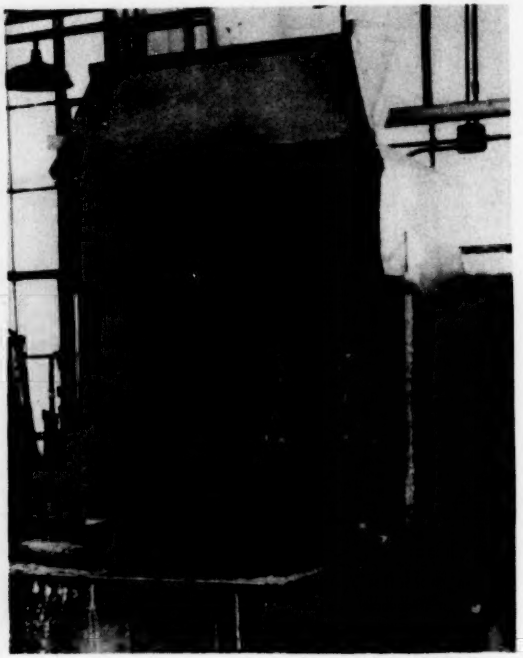
Exhaust volumes for furnaces in this group will usually be in the approximate order of 2,500 cfm for each furnace.

Ladle heater ventilation has proved good practice in the brass foundry. A canopy type hood for two such preheaters, exhausted by 8,000 cfm, is shown in Fig. 1. More complete hooding requiring 2,000 cfm for each preheater may be possible, as indicated in Fig. 6.



Paragon Aluminum Co., Monroe, Mich., and Michigan Department of Health, Lansing, Mich.

Fig. 9. Canopy type hoods have proved satisfactory for aluminum foundry holding furnaces.



Detroit Bureau of Industrial Hygiene

Fig. 10. Hood for molten cyanide furnace is exhausted by 1,500 cfm to provide indraft velocity of 200 fpm.

The electric arc furnace is used extensively in steel foundry practice and occasionally in non-ferrous melting. An exhaust hood mounted on the roof ring will provide all the advantages of local exhaust ventilation with exhaust volumes a fraction of the quantity required where general ventilation through roof fans or roof ventilators is employed. Fig. 7 illustrates the use of local exhaust ventilation with effective hood construction to confine and prevent dispersion of gases, fumes and dust from a melting operation.

In the metallurgical and chemical field, hoods for electric melting furnaces take on the appearance of rooms or enclosures over the top of the furnace, as indicated in Fig. 8. Mechanical charging of the material becomes necessary and the hood must provide access openings for roding and leveling the charge. Huge access doors permit adding new electrodes by the overhead crane. For such furnaces, exhaust volumes of 25,000 to 50,000 cfm will be required even with the effective enclosure noted.

Modifications of the canopy type hood can be used for holding and melting furnaces such as shown in the aluminum foundry installation, Fig. 9. A volume of 8,000 cfm was exhausted from the two hoods that are illustrated.

For molten cyanide heat-treat furnaces, usually a complete cylindrical enclosure can be provided with relatively small access opening in the periphery. For larger parts, more open hood, Fig. 10, may be necessary. An overhead hood can be hinged where necessary to provide access for the operation of an overhead crane.

Experience is my Classroom

By T. W. REYNOLDS

• SAND AND RADIANT HEATING

Sand, a very useful material in its proper place, can create a lot of difficulties when present in the floor coils of a radiant heating system. Of course, such coils are protected at their open ends while lying on the site, but the boiler may not be. Recently, a cast-iron sectional boiler when dumped on a pile of sand, collected quite a lot of this sand in its waterways and when erected circulated the sand through the coils until they became plugged. The presence of sand having been noted when flushing out the boiler, it was decided to blow out the coils under pressure. It took 400 lb of pressure to do this; fortunately, the coils were of copper and withstood the pressure.

• FREE CARBON IN THE AIR

In the published works on investigation of atmospheric dust, no differentiation has been made between free carbon and combined carbon, the results of carbon analysis usually being expressed as *total carbon*. Total carbon, of course, would include not only the free carbon but all the carbon bound in molecules of the various organic matter in the dust, such as seed spores, cellulose fragments, lint, and many other things of similar nature. Although such materials contain carbon, they do not have the soiling properties of free carbon, which is what we are most concerned with in such applications as stores, for example. Free carbon consists mainly of soot from the combustion of coal, coke, oil, wood, and the exhaust carbon from gasoline and Diesel engines.

In order to obtain some idea of the percentage of this free carbon constituent in atmospheric dust the American Air Filter Company collected samples in 25 different locations, more than half of these samples being collected in April and May of 1949. The samples were also analyzed for total non-combustibles, silica, and mixed oxides. The silica and mixed oxides represent a portion of the non-combustibles, but not all, and therefore their sum does not equal the percentage in the non-combustible column. The free carbon represents only a portion of the combustibles. No analysis was attempted to determine the percentage of other combustible materials, so they do not appear in the table. It is therefore apparent that since analysis was not made to determine all the components, the percentages will not add up to one hundred.

The average free carbon content of the 25 samples analyzed is 32%. The maximum, 56%, was found at Shawinigan Resins, Indian Orchard, Mass., and the minimum, 8%, at Travelers Insurance Co., Hartford, Conn. The free-carbon distribution of these samples is:

% Free Carbon	No. of Samples
Over 50	1
40 to 50	4
30 to 40	10
20 to 30	8
10 to 20	1
Under 10	1

Results on samples (1949) from Pittsburgh and Chicago are shown in Table 1. These are typical and illustrate the difference in carbon that may be expected in the same city at different time intervals. These variations appear to be as great as variations between cities.

TABLE 1.

Installation Location	Remarks	Percent by Weight			
		Free Carbon	Non-Combust.	Silica	Mixed Oxides
Joe Low Corp., N. Elston Ave., Chicago, Ill.	Industrial area — intake on roof of second floor. 100% fresh air.	27.05	52.51	21.46	21.26
Phoenix Metal Cap Co., 16th Street, Chicago, Ill.	Near RR switchyard. Intake on roof of 4th floor. Not clean area, but typical of industrial Chicago. 100% fresh air.	42.27	47.29	21.78	18.42
Whittier Elem. School, Pittsburgh, Pa.	Good residential area. Air intake on roof 50 ft above street. 70% fresh air.	33.96	50.75	24.60	12.73
Letsche Elem. School, Pittsburgh, Pa.	Poor residential area. Intake 40 ft above street. 100% fresh air.	46.65	34.79	15.23	12.1
South Vocational High School, Pittsburgh, Pa.	Near industrial and business section — intake 40 ft above street. 50% fresh air.	36.03	45.08	20.07	18.81

• ALL IN A DAY'S WORK

In the midst of all the bustle, the office engineer wants to know if you won't drop everything and dictate for the record the results of your interview, conference, or business trip before your memory dims. Who knows but you might drop dead and leave someone else holding the bag. It is true that lawyers do record each telephone call, just to substantiate later fees. Engineers, likewise, can save themselves some trouble on rare occasions by having complete notes on forgotten things. I doubt, however, whether this theoretical advantage is worth one's time, paper, and storage space. As the files grow, ten chances to one the notes will become buried anyway.

Bigger things can be neglected while attending to such paper work, so that you turn to your correspondence and find that the steam traps are said to be leaking on such and such a job. Now traps sometimes do anything but trap, and again they are aptly named and trap anything they were not intended to trap. It's one of those things, that the devices we put in to prevent troubles, such as plumbing and steam traps and strainers, do upon occasion create so many troubles in themselves. Still, we couldn't very well do without them.

A second letter says that someone with good intentions insulated a high pressure steam line and now the steam is too hot for a particular process, and that certain of the ducts have been changed in shape and now they are so wide that sprinkler heads must also be installed below them. You turn to the third letter in the hope of better things and learn that out west block busters and heavy trucks have been used to destroy old walls. They have been so effective on demolition that resulting vibrations have caused underground sewage and well water to enjoy one another's company; in fact, one plugged sewer was emptied by the municipality by simply pumping out an adjacent well.

A saving sense of humor is a necessary part of all construction, so the building superintendent out there cannot miss such an opportunity without terminating his missive with "All's well that ends well." He is far away and safe.

• FILTER AND COIL ARRANGEMENTS

A review of plans and actual installations over a period of years reveals many different arrangements of filters and coils in air conditioning systems. This is because of varying requirements from job to job, or sometimes for no reason at all.

Filters should always be installed ahead of coils to keep the coils cleaner. They also *tend* to decrease turbulence and stratification at the coils. In Fig. 3, however, should the filters have to be serviced while the system is operating, then the heating coil should precede the filter to avoid freezing of the servicer.

The usual pressure-type lint screen before an electrostatic filter evens out the air to a certain extent and also prevents sparking where lint is prevalent, as in department stores, so that the ordinary filter may be omitted. It has been used only in a few cases where the approach to the electrostatic filter is so abrupt that resulting turbulence causes too high a velocity over parts of the electrostatic filter. Such a difficulty may be easily overcome if the fan has a convenient means for speed reduction.

The ordinary filter does not increase the efficiency of an electrostatic filter and in fact it decreases the efficiency, since the electrostatic filter has less work to do, the work it would have done anyway if given the opportunity. Coils should always be installed after electrostatic filters and any sterilizing lamps to keep the coils cleaner.

In Fig. 2 the air at differing temperatures will give less stratification because the tempered fresh air, recirculated air, and resultant mix, are at higher than outdoor temperatures. Their temperature differences are also less. This method gives a smaller coil at the outdoor air, but does require two coils, one of which must be of the non-freeze type, together with two sets of piping connections and controls. A further disadvantage is that it does not allow 100% outdoor damper operation, as in Fig. 1. Incidentally, in Fig. 1, as the outdoor damper opens wider to an approach of 100%, there will be an ever diminishing stratification.

In Fig. 1 the heating coil after the cooling coil helps on re-heat and acts as an eliminator of moisture from the cooling coil. In Fig. 3, the heating coil precedes the cooling coil to avoid possible freeze-up of the cooling coil. There is no need of heating coils in Fig. 1 and 2 when there are booster coils elsewhere in the system. In such an event, the heating coil in Fig. 3 would be controlled to heat only to 50F instead of 85F.

Turbulence set up within a fan cannot always be depended upon to eliminate stratification. Sometimes colder air seems to follow the scroll of a fan regardless of whether the fan blows or draws through the coils. Theoretically, a fan should not draw through an electrostatic filter as the suction set up may cause the air (highly cleaned at considerable expense) to become contaminated. Actually, the physical conditions are often such that this must be done. In the case of sterilizing, a blow-through arrangement is a must to avoid contamination of the sterile air.

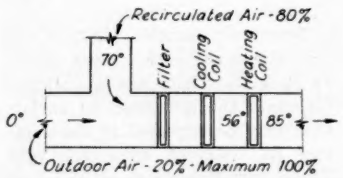


Fig. 1

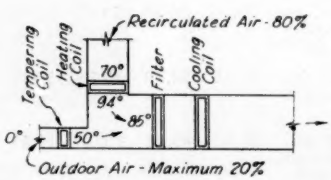


Fig. 2

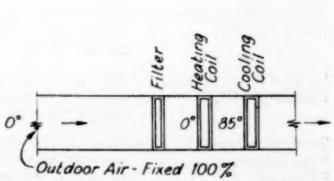
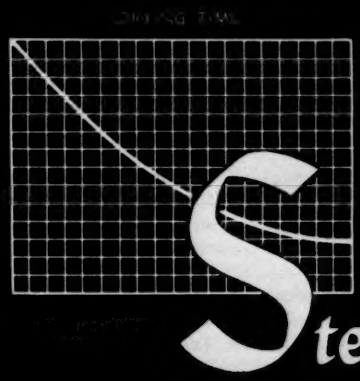


Fig. 3



Steps in the Selection of DRYING EQUIPMENT

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Steps in the Selection of Drying Equipment

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Rules are given for the proper selection of a dryer for a given service. Six examples are introduced to clarify the procedure in solving special problems. Emphasis is placed on the importance of drying as a unit operation and methods are outlined for classifying dryers.

ALMOST every solid article which is available on the market today has been subjected to a drying operation at least once, and many have probably been subjected to several drying operations.

Although there are many secondary reasons, the principal one for drying a wet solid material is to put it in suitable form for marketing, for further processing, or for preservation. Dry materials can almost always be shipped at less expense and with less danger from deterioration. Sometimes it is necessary to dry materials to permit further processing. Using a dry material will often increase the capacity of the processing equipment. Many times, controlled methods of drying will give products of unusual physical characteristics such as soap powders and flakes.

Drying of solids can be defined as the operation whereby a solid, either in solution, in suspension, or wetted by a liquid, is separated from the liquid by the application of thermal energy or its equivalent. This application of thermal energy distinguishes drying from the operations termed dewatering, draining, or filtration.

Unfortunately, distillation and evaporation are sometimes used to separate a liquid from a solid and these operations can only be distinguished from a drying operation by the equipment used. In general, distillation and evaporation are used to separate a large quantity of liquid from a small amount of solid and will only give an incomplete separation so that the final removal of the liquid must be accomplished by drying.

The drying operation is sometimes termed a finishing operation because, particularly in the processing of chemicals, this operation usually occurs near the very end of the manufacturing process. In general, drying will usually follow mechanical dewatering equipment such as filters, screens, squeeze rolls, or centrifuges because the removal of a liquid from a solid is always much less expensive to accomplish mechanically than thermally. Thus, economics will almost always demand that as much water as possible be removed mechanically from a solid before the material is subjected to drying. The drying operation is frequently followed by size reduction, packaging operations, and finally storage. With certain types of dryers it is possible to combine mechanical dewatering and grinding with the drying operation. Oftimes this will result in a reduced over-all cost for these operations.

Drying is a complicated operation in that a dryer will almost always involve several basic operations as heat transfer, mass transfer, and material transport. In some dryers, size reduction, agitation, and dust collection may also play an important part. Since (1) a number of basic operations are involved in drying; (2) several methods are available for accomplishing these operations; (3) the sequence can be interchanged; and (4) materials handled may range from fabrics and automobile fenders to milk and extremely poisonous dusts, it is understandable why there are so many different types of drying equipment marketed today. These types will generally vary in (1) the method of supporting or transporting the material to be dried, and (2) the method of applying heat to the material.

Thus the problem of selecting the proper dryer for a given material revolves about the selection of the least expensive equipment for mechanically handling the material to be dried while the material is being subjected to heat in the most efficient manner. The objective is to obtain the highest quality for the product, with a minimum of product loss. The final selection will almost always represent a compromise between mechanical design, heat efficiency, quality, and product loss. However, in the ultimate analysis, drying is primarily a material handling problem. While it is seldom difficult to successfully apply heat to a material, it is often quite difficult to handle the material properly during drying to give it the desired product form. Such problems as shrinkage, particle-size control, dust losses, uniformity and surface finish will depend (1) on the handling of the material, and (2) on the method of applying the heat to the material.

Classification of Drying Equipment

The selection of the proper dryer for a given material can be facilitated by proper classification of drying equipment. A classification of drying equipment can be made in three different ways such as (1) the mechanical method used to convey the material being handled—rotary dryers, belt dryers and truck dryers; (2) by the materials which they are suitable for handling—fine powders, large objects and discontinuous sheets; (3) by means of which heat is transferred to the material being dried. Classification (1) is almost

Numbers in parentheses refer to bibliography at the end of the article unless otherwise indicated.

useless since many different classes of materials can be handled by the same general mechanical method, and the operating characteristics of dryers using the same nominal conveying methods may vary widely. Method (2) is extremely useful in selecting the type of dryer suited to a given material but it will not generalize the operating characteristics of the various types. A classification of this type is given in Table 2. It indicates that suitability of the more common types of dryers for handling solutions, slurries, sludges and pastes, fine free-flowing powders, granular materials, large objects, continuous and discontinuous sheets.

From the standpoint of understanding the operation of the drying equipment, and the effect of the many operating variables on its performance, the best method of classifying drying equipment is by the predominating mechanism by means of which heat is transferred to the material (2). Heat can be transferred to a wet material by at least four methods such as (1) conduction from a warmer solid body; (2) convection from a heated fluid—usually air; (3) radiation from warm surroundings or heated elements; and (4) generation of heat within the material by dielectric loss in a high-frequency electrical field. Although all four methods may be employed simultaneously, in general, only one predominates.

Marshall (2) has classified those dryers in which convection is the predominating mechanism as *direct dryers;* those in which conduction is predominating as *indirect dryers;* and infrared and dielectric dryers as a *miscellaneous* class. Each class also can be arbitrarily broken down further to batch and continuous dryers. This method of classification has been used for the dryers listed in Table 1.

Direct Dryers—All dryers of this type, which depend primarily upon convection to transfer heat to the material being dried, have a number of characteristics in common. The heating medium is usually air although inert gases or superheated vapors can be used. Temperatures of the heating medium ordinarily range up to 1,400F; with special materials of construction, higher temperatures can be used. When temperatures below the boiling point of water are used for drying, increasing humidity in the heating medium will tend to decrease the rate of drying. This effect may be very serious at temperatures below 100F and in such cases it may prove economical to install dehumidifying equipment. Generally speaking, the heat efficiency will decrease and the investment cost increase markedly for dryers of this type as the allowable moisture content of the product is reduced to very small values. Since the gas directly contacts the material to be dried, its velocity is often limited by such factors as surface deformation (ripples in paint drying) or dust loss (for fine particles). Dust loss is often a problem, particularly where the material being handled is very valuable or toxic.

Common Types of Direct Dryers—The more common types of direct dryers are listed in Tables 1 and 2. Batch direct dryers can ordinarily be classified as (1) tray and compartment dryers, or (2) batch through-circulation dryers. Since these units are often custom-built for the particular product being handled, their construction varies widely. Continuous direct dryers include tunnel and continuous tray dryers, continuous through-circulation dryers, direct rotary dryers, pneumatic conveying dryers, spray dryers, and direct continuous sheeting dryers. Tunnel or continuous tray dryers and direct continuous sheeting dryers can use any of a large number of conveying means and therefore their design depends to a large extent upon the material being handled. The other four types are each more or less fixed as to the conveying method and therefore the specific designs of each type, although different in minor details, all have a marked similarity.

TABLE 1—CLASSIFICATION OF DRYERS BY METHOD OF HEAT TRANSFER

- Direct Dryers
  - Batch
    - Tray or compartment dryers
    - Batch through-circulation dryers
  - Continuous
    - Tunnel or continuous tray dryers
    - Continuous through-circulation dryers
    - Direct rotary dryers
    - Pneumatic conveying dryers
    - Spray dryers
    - Continuous sheeting dryers
- Indirect Dryers
  - Batch
    - Vacuum shelf dryers
    - Pan dryers
    - Vacuum rotary dryers
  - Continuous
    - Indirect rotary dryers
    - Screw conveyor dryers
    - Vibrating tray dryers
    - Drum dryers
    - Cylinder dryers
- Miscellaneous Dryers
    - Infrared dryers
    - Dielectric dryers

In addition to the dryers which fit into these classes, there are available on the market from time to time, direct dryers of highly specialized design which may be a combination of several of these classes, or combinations of direct with indirect or infrared or dielectric dryers. While these dryers are usually well suited to one specific product, generally they will not have the wide applicability of the classes mentioned.

Indirect Dryers—In indirect dryers, the heat required for drying is conducted through a solid retaining wall to the material to be dried. The vaporized moisture is then removed, either by natural or forced convection, into a gas stream over the material or by the application of a vacuum. Drying temperatures will ordinarily range from below freezing (sublimation drying) to about 1,000F. This top temperature is usually limited by the material of which the retaining wall is constructed. These dryers are particularly applicable to the drying of materials at pressures other than atmospheric or under special atmospheres. Since a gas medium above the material to be dried is not required, or at most only a very small amount is necessary, solvent recovery can be easily accomplished and dusting of the material is seldom a problem. If condensing vapors (usually steam) are used as the heat transfer medium, these dryers will have very high thermal efficiencies. They will only use heat as it is demanded. Since heat must pass through a retaining wall of some sort to the material being dried, the ma-

TABLE 2—DRYER SELECTION CHART

Type of Dryer	Material Being Handled							
	Liquids	Slurries	Pastes and Sludges	Free-Flowing Powders—Smaller Than 100-mesh	Granular, Crystalline or Fibrous Solids—Larger than 100-mesh	Large Solids—Special Forms and Shapes	Continuous Sheets	Discontinuous Sheets
Direct-Batch								
Tray and compartment	N	N	A	A	A	A	X	A
Batch through-circulation	X	X	S	S	S	A	X	X
Direct-Continuous								
Continuous tray								
Tunnel	N	N	A	A	A	A	X	A
Multiple hearth	X	X	S	A	A	X	X	X
Reversing pan	X	X	S	A	A	X	X	X
Vertical turbo	X	X	S	A	A	X	X	X
Continuous through-circulation								
Travelling screen	X	X	S	S	S	S	X	X
Roto-Louvre	X	X	X	S	S	X	X	X
Multi-Louvre and Vissac	X	X	X	X	S	X	X	X
Vibrating tray	X	X	X	X	S	X	X	X
Crystal filter	X	X	X	X	S	X	X	X
Direct rotary	X	X	S	A	A	X	X	X
Pneumatic conveying	X	X	S	A	A	X	X	X
Spray	A	A	S	X	X	X	X	X
Continuous sheeting	X	X	X	X	X	X	A	X
Indirect-Batch								
Vacuum shelf	N	N	A	A	A	S	X	S
Pan	S	S	A	A	A	X	X	X
Vacuum rotary	N	S	A	A	A	X	X	X
Indirect-Continuous								
Indirect rotary	X	X	S	A	A	X	X	X
Screw conveyor	X	X	S	A	A	X	X	X
Vibrating tray	X	X	X	A	A	X	X	X
Drum	A	A	S	X	X	X	X	X
Cylinder	X	X	X	X	X	X	A	S
Miscellaneous								
Infrared	E	E	E	A	A	A	A	A
Dielectric	E	E	E	E	E	A	E	E

Key: X—not applicable; N—can be used but not recommended; S—applicable under special circumstances; E—applicable but expensive; A—applicable.

terials of construction, and the contact between the material being dried and the retaining wall, will often have a profound effect upon the drying rate. With granular materials and powders, agitation is often employed to increase the rate at which heat can be conducted from the solid retaining wall to the main bulk of the material. In general, for any given type of indirect dryers, its capacity will be directly proportional to the heating area employed, all other variables being held constant. This makes very simple scale-up from laboratory or semiworks equipment to plant-scale units.

Common Types of Indirect Dryers—As with direct dryers, the number of different types of indirect dryers available to a prospective purchaser is extremely great. Most of the dryers, however, can be placed in the categories shown in Tables 1 and 2 for indirect dryers. Batch dryers can generally be classed as vacuum shelf dryers, agitated-pan dryers, and vacuum rotary dryers. The continuous indirect dryers can be broken down generally into screw conveyor dryers, vibrating tray dryers, indirect rotary dryers, drum dryers, and cylinder or can dryers.

Unclassified Dryers—Two general classes of dryers cannot be classified as either direct or indirect dryers. These are infrared dryers and dielectric dryers.

Infrared Dryers—These depend primarily upon radiation to supply heat to the material being dried. They are most applicable to the drying of thin layers of material, such as paints and lacquers. In addition, infrared dryers are often used as boosters for other drying equipment to obtain an increase in capacity. If electricity is used as the energy source, the power costs will generally be 2 to 4 times as great as other drying methods. If gas-fired burners are used as a source of radiant energy, gases from the burners must be allowed to lose their heat by convection to the material being dried or else the heat economy will be poor.

Dielectric Dryers — These units depend upon the dielectric loss of a material when placed in a high-frequency alternating electrical field to generate the heat required for drying. This method is most applicable to the drying of bulky materials such as foundry molds and foam rubber. Power cost may be 10 times as great for dielectric drying as for ordinary drying methods, and both investment and maintenance costs are also liable to be high.

With both infrared and dielectric heat, the dryers are usually tailor-made for the product being handled. Only in this manner can effective use be made of the energy available.

Because of the numerous types of dryers which are available to a prospective purchaser, it is often ex-

tremely difficult to select the best dryer for a given material. However, proper selection is important. Most dryers are inflexible. They operate successfully over narrow ranges of temperatures and production capacities. The dryer frequently fixes the final form of the product. Material that is drum-dried will have a final form that is different from a spray-dried material. Often the selection of the dryer establishes other parts of the process. Installation of a batch dryer will many times make continuous dewatering or grinding equipment appear unattractive. For these reasons it is always best to give ample consideration to the selection of a dryer for a given process as soon as the process looks economically attractive.

Procedure for Dryer Selection

Since selection of the proper dryer for a given material is usually very important, a systematic method of making this selection is almost always justified. A general procedure for dryer selection will consist of four steps as follows: (1) the field of drying equipment should be surveyed and the most suitable dryers should be selected; (2) a preliminary cost estimate should be made of the drying operation when using the various types of suitable dryers; (3) based upon the results of this survey, drying tests should be conducted in prototype or laboratory units of the dryers which appear most promising; (4) from these tests, company cost estimates of these dryers when handling the material in question can be prepared, and samples of product can be obtained for quality evaluation. With this information, final selection of the proper dryer can be made on both a cost and a quality basis.

This procedure need not be followed in detail for every drying problem, but when the installed cost of the drying equipment exceeds $10,000, or when the product quality is extremely important, it is believed that the procedure will result in considerable over-all cost and quality savings.

Preliminary Selection of Drying Equipment

A number of factors may enter into the final selection of a dryer. However, before even a preliminary selection of the type of drying equipment is made, it is best to list as many as possible of the controlling factors. This will almost always eliminate a number of the different dryers from consideration. The following paragraphs list typical important factors.

Properties of the Material Being Handled—The physical characteristics of the wet material are of prime importance—whether it is a liquid, sticky or free-flowing. Similarly the physical characteristics, when dry, should be known. The toxicity and flammability of the material must be considered from the safety standpoint. While the corrosiveness and abrasiveness of the material, both in the wet and dry condition, will determine the materials from which the dryer must be constructed, the particle size and shape will often determine the methods by means of which the material can be successfully handled. The value of the material being dried may influence the final decision, since a high cost material will preclude the use of dryers from which yield losses may result.

Drying Characteristics of the Material—The type of moisture associated with the material may influence the dryer selection. It is important to know whether the moisture is (1) all on the surface of the material (sand, crystalline salts); (2) dissolved in the solid (soap, some polymers); (3) adsorbed on the solid (silica and alumina gels); (4) in the form of a hydrate; or (5) any combination of these possibilities. The initial and desired final moisture content will directly determine the size of the equipment required. Permissible drying temperatures should be known. This is often difficult to evaluate, since the permissible drying temperature is almost always a function of drying time. Heat-sensitive materials can often be subjected to temperatures several hundred degrees F higher in spray or flash dryers, where the drying time is a matter of seconds, than would be permissible in tray dryers where the drying time is a matter of hours. Based upon experience, the drying time in different types of dryers should be estimated whenever possible.

Flow of Material to and from Dryer—In this category, the most important factor is the quantity of material to be handled per unit of time. The operation prior to and following the drying step should be known. Whether these associated operations are batch or continuous in nature may influence the selection of the drying equipment. Also, the possibility of combining drying with either a dewatering or grinding operation should be considered.

Product Qualities—Since the drying operation is frequently the last operation in a process prior to packaging and final marketing, the quality of the product from the dryer may be fixed either by existing or proposed product specifications. These specifications may cover a wide variety of properties. Shrinkage of the product after drying (cloth) or during drying (pottery and wood) may be important. Many products as pharmaceuticals, pigments and food products must be free from contamination. Uniformity of final moisture content may influence subsequent use of the material. Specifications on product decomposition must almost always be considered with temperature-sensitive materials. The state of subdivision of the product and its uniformity will often influence product salability or end uses. Bulk density of the product will have an important bearing on packaging method and shipping costs.

Recovery Problems—Two principal recovery problems may be involved in a drying operation. The first is recovery of any dust which may be formed. Dust recovery equipment is almost always justified economically, particularly if the material is of moderate value. In addition, regard for elimination of atmospheric pollution may necessitate dust recovery. If toxic materials are handled, dust control will be required as a personnel safeguard.

The second recovery problem is met when handling solvent-wet materials. Whenever possible, solvents should be recovered. A loss of solvent equivalent to just 1% of the solvent on the material before drying may represent an expense greater than the cost of the entire drying operation. When handling solvent-wet material, indirect dryers are much more generally

TABLE 3—DATA REQUIRED FOR SOLVING EXAMPLES FOR SELECTION OF DRYING EQUIPMENT

Item	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6
Material Characteristics						
Designation	Inorganic salt	Organic compound	Organic cellular blocks	Wood chips	Fabric	Organic liquor
Specific heat, Btu/(lb)(F)	0.21	0.35	0.2	0.55	0.40	0.35
Mean particle or product size	1800 microns	100 microns	6 x 8 x 1 ft	½ x ½ x 1/16 in.	40-in. wide	.....
Toxicity	None	May be toxic	None	None	None	None
Corrosiveness	None	Must use Type 304 stainless steel	None	None	None	None
Dry bulk density; lb/cu ft	80	40	3	12	.....	?
Liquid to be removed	Water	Benzene	Water	Water	Water	Water
Wet form	Granular, relatively free flowing	Sludge	Block	Chips	Sheet	Solution
Desired dry form	Granular, free flowing	Free flowing, non-lumpy	Block	Chips	Sheet	Free flowing, soluble powder
Est. initial moisture content, % dry basis	3.6	55	85	40	50	400
Desired final moisture content, % dry basis	0.1	0.1	3	6	7	4
Max. allowable temperature wet, F	375	140	180	250	225	?
Max. allowable temperature dry, F	375	225	180	180	225	?
Temp. of wet material, F	80	70	100	50	90	150
Production Requirements						
Process prior to drying	Continuous centrifuge	Batch filtration in filter press	Leeching	Storage	Coating	Evaporation
Process following drying	Storage	Grinding	Cutting into smaller blocks	Packaging	Slitting	Packaging
Maximum continuous production rate, dry, lb/hr	1,200	.....	.....	750	1,500	150
Batch size, dry, lb	.....	1,000	1 block	.....	.....	900
Number of batches per day	.....	3	100	.....	.....	4
Required evaporation rate, lb/hr	42.5	68.8	492	255	645	594
Facilities at Site						
Existing or new plant	New	Existing	Existing	Existing	New	New
Space available at site	.....	Second floor available, 12 ft head room, 15 ft by 40 ft floor space	One room available, 25 ft by 35 ft by 12 ft high	None	.....	.....
Fuel available	Oil	.....	Gas	Oil	.....	.....
Heating value of fuel available	135,000 Btu/gal	.....	500 Btu/cu ft	140,000 Btu/gal	.....	.....
Pressure of steam available, lb/sq in	150 and 35	125 and 25	150 and 25	200,125, and 25	125 and 25	150 and 35
Electrical power available	220 and 440 v, 60 c	220 and 440 v, 60 c	220 and 440 v, 60 c	220 and 440 v, 60 c	220 and 440 v, 60 c	220 and 440 v, 60 c
Cost Information						
Value of product	$.04/lb	$1.25/lb	$1/cu ft	$.05/lb	$2/sq yd	$4/lb
Value of solvent, $/lb	.....	0.031	.....	.....	.....	.....
Labor cost, $/hr	2.00	1.85	2.25	1.65	1.90	2.00
Electrical cost, $/kwh	0.01	0.01	0.007	0.012	0.01	0.01
Steam cost, $/1,000 lb	1.00	0.90	1.25	1.00	1.00	1.30
Fuel cost	$0.09/gal	.....	.....	$0.08/gal	.....	.....
Depreciation rate, %/yr	5	7	6	5	6	8

NOTE: Example 3—shrinkage should be kept at a minimum. Example 5—fabric should be dried without shrinkage. Example 6—to prevent contamination, only stainless steel construction can be used.

applicable and less expensive to operate, over-all, than direct dryers.

Facilities at Site—If a dryer is to be installed in an existing plant or factory, a number of factors must be considered. While these same factors must be kept in mind for new plant sites, they may not be quite as important as for an existing plant. Space available may limit the type of equipment which can be installed. The temperature, humidity, and cleanliness of the air may be significant. Available heat sources, particularly where waste steam or flue gases can be used, may govern the equipment selection. Type and availability of electrical power, expressly if infrared or dielectric drying is being considered, may be important. Permissible noise, vibration, and dust are often factors. If a dryer is to be installed in an air con-

ditioned area, high heat losses will result in increased air conditioning costs. The physical location of the wet material before drying, its probable final storage place, and available exhaust gas outlets may govern both location and type of dryer. Weight limitations on existing floors or foundations must be considered.

Actual Preliminary Selection

When the foregoing items are established, enough information is then available to make a selection of the dryers. Not only is this information needed to make the preliminary selection, but it is the same information which most reputable vendors of drying equipment like to have before submitting price quotations on their drying equipment for a given job. This information can be most easily summarized in a form similar to that shown as Table 3.

With this information at hand, Tables 2 and 4 can be used to make a preliminary selection of the dryers which may be suitable. At this stage, all dryers which appear even remotely suitable should be listed. Depending upon the material being handled, the number of dryers which can be considered may range from 1 or 2 up to as many as 6 or 8.

Except when handling very special materials, many times it is a mistake merely to order another dryer of an existing type when increased capacity is required. Although this is undoubtedly the easiest solution, it precludes the possibility of process improvement or cost reduction. Numerous improvements in drying equipment and techniques are being brought on the market every year and, wherever possible, these should be incorporated in new construction and expanded facilities. In addition, the increased knowledge of the product being handled, gained over years of production, may have eliminated or reduced in number many of the factors considered important when the first dryer was selected; other factors may be more vital than originally considered. Also, product specifications may have been changed in the interim. Thus, if a major expansion of drying facilities is being considered, the same care should be given to the final selection of equipment as would be given to drying equipment for a new product.

Initial Comparison of Dryers

After the dryers which may prove applicable have been selected, it is wise to make a critical comparison. This is particularly important if a number of dryers appear suitable, for it will usually help reduce the types of dryers to be considered.

The principal basis for comparison should be the operating and investment costs of the various dryers. To estimate these costs, it will be necessary first to estimate the size of the equipment which will be required. While such methods are beyond the scope of this article, the size can be estimated either from data on existing dryers, if such data are available, or from published data in the literature. Much of this plus considerable new data has been summarized by Marshall and Friedman (3).

Once the approximate sizes of the types under consideration are known, the investment costs and probable operating costs should be estimated. Although this information is not easily compiled, because little has been published on operating or investment costs of dryers, Marshall and Friedman (3) give fairly complete data for estimating roughly the labor, power, fuel, and investment for most of the common types of dryers. Investment costs of some dryers have also been given by Bliss (5), Chilton (6), and Tyler (7). When using investment costs from any of these sources it is important that the costs be brought up to date by use of appropriate equipment cost indexes, such as are published by *Engineering News-Record* or *Chemical Engineering*.

If investment cost data cannot be obtained from these sources, preliminary quotations from vendors of the equipment being considered can often be obtained. It will usually be necessary to furnish the vendor with all the information listed in Table 3 plus your estimated size for his equipment. Many of the reputable vendors will not quote on a dryer unless the size is specified or they are allowed to test the material. Since it is costly and time-consuming to run tests at this initial stage, it is almost always better to ask for a quotation on a given size, provided the size can be estimated within reasonable limits.

After operating and investment costs of the various dryers are estimated, these should be critically compared. Dryers which appear unattractive economically should be discarded from consideration. It is important to include solvent and dust losses as operating costs in this comparison, since these may overshadow all of the other costs. It may also be necessary to consider not only the drying operation but also the processes preceding and following drying (such as filtration, grinding, and solvent recovery problems) to obtain the complete economic picture. The type of dryer may influence these operations. Only in the case where unique and valuable properties may be imparted to the product by a special dryer, should any type receive further attention, that is more expensive to purchase or to operate than others. Usually this preliminary economic analysis will reduce the number of possible dryer types to 4 or less.

Drying Tests

Before the final type and size of dryer for a given material can be selected, it will almost always be necessary to conduct drying tests with equipment simulating that of the plant size dryer being considered. Insofar as possible, these tests should be conducted for all types of dryers deemed applicable, after the preliminary comparison. These tests will permit an accurate estimate of the plant scale size of each dryer and will also furnish some material for product evaluation.

Almost all of the large and reputable vendors of drying equipment maintain laboratories in which drying tests can be run, often at no expense to the prospective customer. It is always wise, whenever possible, to avail oneself of these facilities for (1) it insures proper conduction of the tests and correct interpretation of the test results; and (2) less expense

TABLE 4 — GENERAL TYPES OF DRYERS

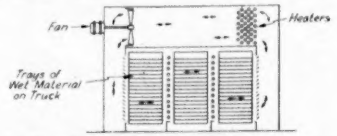
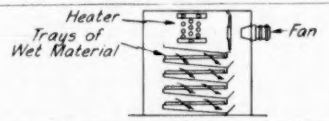
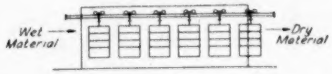
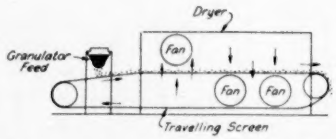
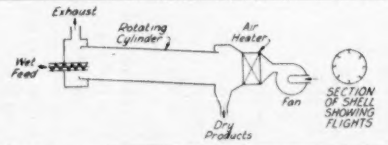
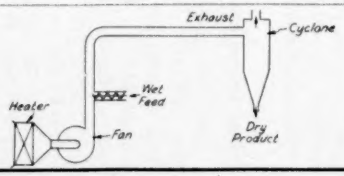
Generic Type	Schematic Representation	Related Dryers	Field of Application	Typical Products	Representative Mfrs.
Direct Batch Dryers					
Tray and Compartment		Lumber and ceramic kilns Drying rooms Baking ovens Loft dryers Skein dryers	Most applicable for drying small batches of materials and for development studies. Seldom used for capacities exceeding 50-100 lb per hr of dry product. Suitable for handling small batches of different materials in a single unit. Almost any material can be handled.	Pharmaceuticals Dyes Pigments Lumber Ceramic ware Foundry cores Painted or dipped objects Plastics Fruits and vegetables Granular chemicals	Despatch Oven Co. Lydon Brothers, Inc. National Drying Machinery Co. Proctor & Schwartz, Inc. W. S. Rockwell Co. J. O. Ross Engineering Corp.
Batch Through-Circulation		Bin dryers	Used for granular materials where production requirements may be somewhat higher than for tray dryers. Material being handled must be sufficiently granular to permit circulation of air through a bed of the material.	Grain Smokeless powder Hay Pharmaceutical tablets Crystalline pharmaceuticals	Lydon Brothers, Inc. National Drying Machinery Co. Proctor & Schwartz, Inc.
Direct Continuous Dryers					
Tunnel and Continuous Tray		Reversing pan dryers Continuous belt dryers Vertical turbo dryers Multiple hearth dryers	Dryers of this type may be used for all materials that can be dried in tray and truck dryers. They are commonly used for handling large volumes of materials. Special designs for the conveyors are often used for special materials such as leather, wood veneers, tobacco, etc. Vertical turbo dryer is generally restricted to free-flowing materials. Continuous belt and reversing pan dryers work best with non-sticky products.	Fruits and vegetables Dyes and pigments Ceramic ware Leather ware Foundry cores Painted or dipped objects Rayon cakes and skeins Granular chemicals Wood veneers	Despatch Oven Co. Kirk & Blum Mfg. Co. Lydon Brothers, Inc. National Drying Machinery Co. Proctor & Schwartz, Inc. W. S. Rockwell Co. J. O. Ross Engineering Corp. Wyssmont Co.
Continuous Through-Circulation		Roto-Louvre dryer Multi-Louvre dryer Vissac dryer Oliver crystal filter dryer Vibrating tray dryer Dwight-Lloyd-Oliver dryer	Conveying screen dryers are generally applicable for handling fibrous, flaky, or large granular materials. Sometimes they can be used with sticky sludges or fine materials by use of a proper preforming device before the screen. They are not suitable for powdery materials. The Roto-Louvre dryer is applicable to granular materials, 100-mesh or larger in size. Multi-Louvre and Vissac dryers are only good for very large granules. Vibrating screen dryers are principally used for free-flowing, coarse granular materials. Crystal filter dryers are applicable to crystalline or granular materials that are easy to dry.	Grain Coal Wool Cotton linters Rayon staple Preformed or granular chemical materials Starch Lead arsenate Calcium carbonate Lithopone Clay Plastics	Arid-Aire Mfg. Co. James Hunter Machine Co. Jeffery Mfg. Co. McNally-Pittsburg Mfg. Corp. National Drying Machinery Co. Proctor & Schwartz, Inc. W. S. Rockwell Co.
Direct Rotary		Direct kilns Indirect-direct rotary	Usually used for free-flowing granular materials. Sometimes special flight construction or pre-mixing of feed will permit the handling of materials which are not completely free-flowing. Indirect-direct types are not well suited to handling heat-sensitive materials. Fine dusty materials usually cannot be handled without excessive dust losses.	Sand and clay Crushed stone Sodium nitrate Ammonium sulfate Coal Sugar Copper sulfate Ilmenite Limestone Salt and Glauber's salt	C. O. Bartlett & Snow Co. Blaw-Knox Co. General American Transportation Corp. Hardinge Co., Inc. Hersey Mfg. Co. Struthers-Wells Corp. Traylor Engineering & Manufacturing Co.
Pneumatic Conveying		Flash dryer (combines drying with grinding) Vertex dryer Fluidized solids dryers Ring dryers Gravity-fall dryers	Particularly suitable for materials that be suitably dispersed in a gas stream and conveyed and which possess only surface moisture. Very abrasive materials, materials which cannot be broken, and materials which tend to stick to walls of ducts are not suitable. For materials containing internal moisture, several stages may be required. Dryers of this type are particularly suited to the handling of large capacities (2000 lb per hr evaporation and greater). These dryers are often used in conjunction with a closed circuit grinding operation.	Coal Sodium chloride Wood flour Sewage sludge Clay Copper sulfate Gypsum Strontium nitrate Ammonium sulfate Miscellaneous filter cakes	Combustion Engineering Co., Inc.

TABLE 4 CONTINUED — GENERAL TYPES OF DRYERS

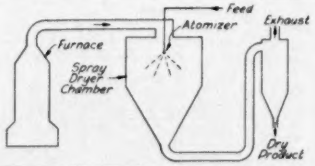
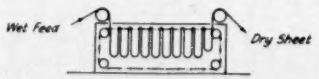
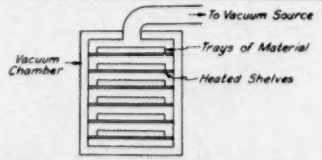
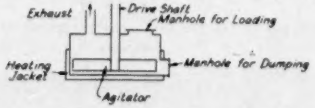
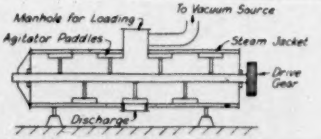
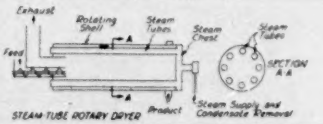
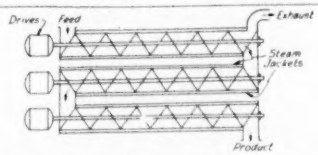
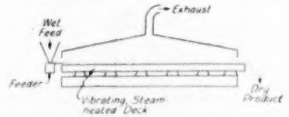
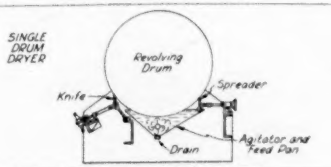
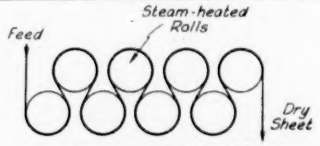
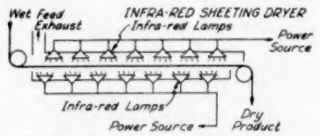
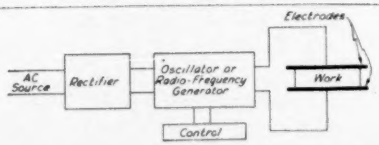
Generic Type	Schematic Representation	Related Dryers	Field of Application	Typical Products	Representative Mfrs.
Direct Continuous Dryers—Continued					
Spray			Used to dry solutions, slurries, and pastes. In general, any material that can be pumped can be spray dried. It is particularly applicable to drying heat-sensitive materials. This method of drying is especially attractive at evaporation rates exceeding 1000 lb per hr of water.	Eggs Milk Coffee Dyes Corn syrup Polyvinyl chloride Urea-formaldehyde resins Synthetic detergents Soap powders Pharmaceuticals Distillers' solubles	Bowen Engineering, Inc. Buflovak Div., Blaw-Knox Co. Instant Drying Corp. Niro Corp. C. E. Rogers Co. Swenson Evaporator Co. Western Precipitation Corp.
Continuous Sheeting	 FIXED-FESTOON DRYER	Multi-Pass Airlay Tenter dryer Fixed festoon dryer Loose festoon dryer Fixed roll dryer Tower dryer Horizontal multi-pass Vertical multi-pass Double arch dryer	Suitable for continuous sheet materials that are sufficiently strong mechanically in the wet and dry state to support their own weight or withstand any tension required.	Textiles Synthetic rubber sheeting Coated paper Photographic film Coated fabrics Plastic sheeting (cellophane, etc.)	James Hunter Machine Co. National Drying Machinery Co. Proctor & Schwartz, Inc. W. S. Rockwell Co. J. O. Ross Engineering Corp.
Indirect Batch Dryers					
Vacuum Shelf		Sublimation dryers	Used extensively for drying temperature-sensitive or easily oxidizable materials that would otherwise be handled in other dryers and materials which are sufficiently valuable that handling costs are a small fraction of the total finished product cost. Well-suited to the recovery of valuable or toxic solvents. Hygroscopic materials can be dried at lower temperatures than would be required in atmospheric dryers. They are best suited to low production rates.	Dyes Pigments Pharmaceuticals Streptomycin Penicillin Blood plasma	Buflovak Div., Blaw-Knox Co. H. K. Porter Co., Inc. F. J. Stokes Machine Co.
Pan		Vacuum pan dryer Atmospheric pan dryer Graining bowl Dopp kettle	Used to handle small batches of material that must be agitated during drying. Pastes and slurries can be handled if a continuous dryer cannot be justified. Solvents can be recovered with vacuum pan dryers. This type of dryer is not suitable for materials that cannot suffer particle-size degradation during drying.	Catalyst supports Sodium nitrate Bran Sawdust Zinc dust Pigment and dye slurries	Allis-Chalmers Co. C. O. Bartlett & Snow Co. Buflovak Div., Blaw-Knox Co.
Vacuum Rotary			Used to dry large batches of materials which must be dried in the absence of air or from which solvents are to be recovered. It will handle materials ranging from sludges to coarse crystals if the material does not cake to the walls or the agitator severely. Some grinding usually takes place. They are best used for a single material rather than several materials because of difficulty of cleaning.	Dyes Dye intermediates Powdered metals Cellulose acetate Starches Sulfur black Rotenone	Blaw-Knox Div., Blaw-Knox Co. Buflovak Div., Blaw-Knox Co. H. K. Porter Co , Inc. F. J. Stokes Machine Co. Struthers-Wells Corp.
Indirect Continuous Dryers					
Indirect Rotary	 STEAM-TUBE ROTARY DRYER	Steam-tube rotary dryer Jacketed cylinder dryer Fire-tube dryer	Suited to the continuous drying of granular or powdery materials that can be dried at high temperatures but cannot stand contamination from products of combustion. They are particularly suited to dusty materials which cannot be handled in a direct rotary dryer. These dryers cannot be used for materials which tend to stick to hot surfaces.	Citrus wastes Titanium dioxide Clays Carbon black Dolomite dust Ethyl cellulose Mica Distillers' slops	Allis-Chalmers Co. C. O. Bartlett & Snow Co. Blaw-Knox Co. General American Transportation Corp. Hardinge Co., Inc. Struthers-Wells Corp. Traylor Engineering & Mfg. Co.

TABLE 4 CONTINUED — GENERAL TYPES OF DRYERS

Generic Type	Schematic Representation	Related Dryers	Field of Application	Typical Products	Representative Mfrs.
Indirect Continuous Dryers—Continued					
Screw Conveyor		Trough dryer	Usually used for granular, free-flowing materials and often will serve as a conveyor as well as a dryer. Some product degradation takes place. These dryers can often be adapted to continuous operation under vacuum by using specially designed charging and discharging parts. Continuous drying and solvent recovery can thus be effected.	Soy bean flakes Cottonseed meal Granular chemicals	Allis-Chalmers Co. Buflovak Div., Blaw-Knox Co. Fuller Co. Paterson Foundry & Machine Co. Struthers-Wells Corp.
Vibrating Tray			Can only be used on free-flowing materials which can be conveyed without sticking on a vibrating conveyor. Uniformity of product is usually very good.	Sugar products Chocolate products Fuller's earth Plastics Pharmaceuticals	Jeffery Mfg. Co. Syntron Co.
Drum		Double drum dryer Twin drum dryer Atmospheric drum dryer Vacuum drum dryer	Applicable to solutions, slurries and, if a finned drum is used, to pastes. Drying can be done under vacuum so that solvent recovery is easy. Particularly applicable to handling these materials at evaporation rates up to about 1000 lb per hr. Above this rate, spray drying may be less expensive.	Milk Distillery slop Synthetic detergents Clay Lime sludge Glue Sizing	Buflovak Div., Blaw-Knox Co. General American Transportation Corp. F. J. Stokes Machine Co.
Cylinder		Yankee dryer	Applicable to almost any sheet material that is not adversely affected by contact with heated metal surfaces. They are used extensively when the sheet lacks mechanical strength. Special finishes can sometimes be applied to the sheet surface.	Textiles Paper Plastic films	Lukenweld Div., Lukens Steel Co. Rice Barton Corp. J. O. Ross Engineering Co. Sargent's Sons Corp. Textile-Finishing Machinery Co.
Miscellaneous Dryers					
Infra-Red		Electric infra-red dryers Gas-fired infra-red dryers	Used extensively for drying thin films or sheet materials. Usually not applicable to bulky objects or thick beds of material.	Smokeless powder Painted objects Finishes Clayware Foundry molds Textiles Molding powders	Burdett Mfg. Co. Fostoria Pressed Steel Corp. Gifford-Wood Co. Miskella Infra-Red Co. J. O. Ross Engineering Corp. Trumbull Electric Mfg. Co.
Dielectric			Applicable to large bulky materials which would ordinarily require hours or days to dry. Power and installed costs are usually high. This method can only be justified by (1) improved product quality, (2) reduced inventory, (3) or reduction in building space required.	Rayon cakes Foundry molds Foam rubber	Allis-Chalmers Co. General Electric Co. Girdler Corp. Induction Heating Corp. Radio Corp. of America Raytheon Mfg. Co. Westinghouse Electric Co.

will be involved in running the tests in the vendors' laboratories than in purchasing or constructing a suitable pilot plant dryer for the tests in one's own plant.

When conducting tests in vendors' laboratories, a representative who is acquainted with the material, its properties, its desirable final form, and the proposed process details should be present. He can help plan test work, specify maximum temperatures and air velocities, answer questions concerning toxicity, probable damage to the material, allowable materials of construction, and production requirements. He can see the vendors' equipment and laboratory, and meet the engineering staff. He will thus obtain some concept as to the reliability of the results obtained. Because of first-hand knowledge of many drying problems, the vendor may offer valuable process suggestions to the representative during the tests.

The extent of the test program will depend to a large extent on the difficulties encountered in handling the material and the rigidity of the specifications on the product. Because plant size dryers are expensive and relatively inflexible, it is wise to conduct sufficient test work on the small-scale equipment to establish optimum operating conditions for the plant dryer. This will consist usually of establishing maximum points of operating temperature, loadings, and air velocities.

When conducting drying tests, it is imperative that the material tested be the same as that to be handled in the final installation. This means that, prior to conducting drying tests, mechanical dewatering or filtration tests must frequently be conducted to establish the initial moisture content of the feed to the dryer. The particle size and prior treatment of the material to be dried must be the same as that contemplated for the final installation. Differences in prior treatment may affect not only the drying time of the material but also the allowable air velocity and sticking or caking qualities of the wet or semi-dried material.

Interim or Pilot Plant

Often in the development of a new product, an interim or pilot plant is constructed. This plant should employ the same type dryer as will be used in the final large plant. Therefore, drying tests on several different types of dryers should be made before the interim plant is built. Use of existing drying equipment for this interim plant will often be false economy unless the available equipment just happens to be the optimum type for the material being handled. The reason for this is that over 90% of the time the type of dryer used for the interim plant will be installed in the final plant because operating know-how has been obtained with this type dryer and because customer acceptance of the product which it produces has been established. Therefore, a change of dryer type between interim and final plants is seldom tolerated.

However, if the final dryer type is selected before the construction of the interim plant, this plant will serve to train operators for the new equipment. Many of the problems which might be encountered in the final plant can be solved. In general, the test work at vendors' laboratories can be restricted to just that necessary to obtain quotations on a final dryer and an interim dryer, if an interim plant is to be constructed. If such a plant is not constructed, the test work at the vendors' laboratory should be expanded to cover all conceivable operating conditions. It may also be desirable to have large batches of the material dried in the type dryer finally selected for customer evaluation. It is customary to pay the vendor for such service. Sometimes custom-drying companies can be found which employ the type dryer under consideration and large batches of material can be processed by these concerns at a relatively nominal cost.

Final Selection of Dryer

After the test work has been completed, price quotations should be obtained for the dryers still under consideration, based on the estimated plant production capacity. Whenever possible, competitive quotations should be obtained for each of the types. After representative quotations are available, the installed cost of each dryer should be estimated.

Once the installed investment cost of each of the dryers has been established, the operating cost should be estimated, including depreciation and maintenance charges. Data on fuel consumption and electrical power requirements will usually be furnished with the quotations. Labor requirements must be decided upon by the operating personnel involved.

These operating and investment costs of the various dryers involved should then be compared critically. The dryer which will perform at the lowest operating cost consistent with the investment involved, should be selected as the dryer for final installation. As was pointed out previously, it is often necessary to consider some of the operations prior to and following the drying operation to obtain a valid cost comparison. Some of the items which may overshadow the operating or investment cost of the drying operation alone, follow:

(1) *Product quality* should almost never be sacrificed to reduced costs. This is particularly true when handling costly materials.

(2) *Dusting, solvent, or other product losses* of only a small fraction of the total material handled may cost more than the entire drying operation.

(3) *Outside construction* is possible with some dryers and this may save substantial investment in buildings.

(4) *Reduced investment for filtration, grinding, conveying, or packaging equipment* may justify the installation of a more costly dryer than would be considered if drying equipment alone were compared.

(5) *Bulk density of product* will directly affect the cost of packaging. When expensive containers are to be used for the product, a high bulk density is generally desirable.

If all of the enumerated factors are considered when selecting a dryer, the engineer responsible for its choice can feel certain that he has recommended for installation the best and most economical dryer for the given service. At the same time he has built up a

TABLE 5—PRELIMINARY COST ESTIMATE FOR EXAMPLE 1

Type of Dryer	Installed Cost, $	Operating Cost, $/100 lb
Tunnel	12,000	0.23
Conveying-screen	16,000	0.13
Roto-Louvre	10,000	0.12
Direct-rotary	9,000	0.12
Pneumatic conveying	5,000	0.13
Indirect rotary (steam-tube)	9,000	0.10
Screw conveyor	7,000	0.11
Vibrating tray	18,000	0.12

back-log of experience and information which will assist in the start-up and operation of the final equipment.

Examples of Dryer Selection

The following examples are given of the selection of drying equipment for different materials. The basic data for all of the examples are contained in Table 3.

Example 1

Conditions—In this example an inorganic salt is to be dried prior to further processing. Complete conditions are given in Table 3.

Preliminary Selection—Referring to Tables 2 and 4, and excluding all batch dryers since they would be too expensive to operate economically at the desired continuous production rate, the dryers which might be used are: tunnel, continuous through-circulation, Roto-Louvre, direct rotary, pneumatic conveying, indirect rotary, screw conveyor, and vibrating tray. Dielectric and infrared dryers are excluded from consideration because of their high operating costs.

Using data which are available for estimating costs (3, 5, 6, 7), the order-of-magnitude of installed and operating costs for these various dryers can be predicted. See Table 5.

As a result of this comparison, the tunnel dryer can be excluded from further consideration because of the high operating cost. For this particular drying job, labor will be the principal cost and the tunnel dryer will require more labor than the other types because of loading and unloading trays. In addition to the tunnel dryer, the conveying-screen dryer can be eliminated because of high investment cost coupled with the probability of plugging of the screen. The vibrating tray also can be neglected because of its probable high investment cost. This then leaves only 5 dryers for further consideration.

Drying Tests—Drying tests are now conducted in small-scale dryers of the types still under consideration. The results of these tests are as follows:

Roto-Louvre dryer—A satisfactory dry product was obtained. No lumping or streaking occurred during drying. Dust losses appeared to be about 0.1% of feed.

Direct-rotary dryer—A suitable dry product was obtained with no sticking in the dryer. Dust losses appeared to be about 0.1% of feed.

Pneumatic conveying dryer—It was found that two stages were required to obtain the required 0.1% of final moisture content. Dust losses were about 0.1% in each stage.

Steam-tube rotary dryer—A satisfactory dry product was obtained with no sticking to the tubes. Dust losses were negligible.

Screw conveyor dryer—A satisfactory dry product was obtained. Dust losses were negligible. Some degradation in crystal size was noted.

With these test results, all dryers appeared applicable. Thus, quotations were obtained for all.

Final comparison—Sufficient data are now on hand to make a critical cost comparison of the five different dryers. This is done with the results shown in Table 6. The dryer which will be the most economical to operate is the steam-tube rotary dryer. The dryer least expensive to install is the pneumatic conveying dryer. The savings in operation by using a steam-tube dryer rather than a pneumatic conveying dryer will amount to almost $2,000 per year. These savings will easily justify the additional expenditure of $2,647. Thus, the steam-tube dryer should be selected for this drying job.

Example 2

Conditions—An organic compound which is produced in 1,000 lb batches every 8 hours is to be dried. It may be toxic and it comes from a slurry in benzene, which is both toxic and flammable. Because of solubility relationships, the wet solid should not be heated above 140F although the dry solid can stand 225F for long periods of time without serious deterioration.

Preliminary selection—From Tables 2 and 4, the dryers which appear to be most applicable are: vacuum shelf, agitated-pan, vacuum rotary, screw conveyor, vibrating tray, and possibly pneumatic conveying. All direct dryers except the pneumatic conveying or flash dryer were discarded because of the need for solvent recovery and possible flammability dangers. The pneumatic conveying dryer can be used with an inert gas system since it is relatively easy to make it a closed system. All of the indirect dryers must be heated by hot water not exceeding 140F during the first part of the drying cycle, although, toward the end, 5 lb steam can probably be used. The pneumatic conveying system will probably require mixing of the wet filter press cake with dry solids to make it handle well. However, it can probably be used as part of a closed system grinding mill, and both grinding and drying can be accomplished simultaneously.

Preliminary investment and operating cost figures are listed in Table 7.

From this comparison, the dryers which appear most promising are the vacuum rotary, screw conveyor, vibrating tray, and pneumatic conveying dryers. Both the vacuum tray and the agitated-pan dryers will require more labor than the other dryers. However, the screw conveyor, vibrating tray, and pneumatic conveying dryers will require intermediate storage so they can be operated continuously.

Drying Tests—Drying tests with the material in question were conducted in the semi-works units of the

dryers still under consideration. The following results were obtained:

Vacuum Rotary Dryer—A satisfactory dry product was obtained when using hot water at 140F as the heating medium for 2/3 of the drying cycle followed by water at 200F for the remainder of the cycle. In a dryer 1.5 ft dia by 2 ft long, a total time of 3 hours was required for proper drying.

Screw Conveyor Dryer—Under all conditions of operation, the material tended to plug the screw conveyor. This dryer was dropped from consideration.

Vibrating Tray Dryer—Wet material did not convey satisfactorily. Mixing dry material with wet feed did not improve conveying. Further work considered unwarranted.

Pneumatic Conveying Dryer—Inert gas temperature was limited to 140F with wet or partially wet material. About 3 parts of dry material had to be recirculated with 1 part of wet material to achieve satisfactory handling. It appeared that 4 stages would be required to obtain the desired final moisture content. Bag collectors will be required to prevent excess product loss. A hammer mill could be used in the last stage to suspend the material in the air stream, thus accomplishing grinding as well as drying.

From these tests, only two dryers were left for active consideration and quotations for these two types were obtained.

Final Comparison—A company estimate of investment and operating costs was prepared as listed in Table 8.

With this cost data it was decided to install the vacuum rotary dryer despite its $17,000 greater investment cost and the need to supply grinding equipment, which would not be required for the pneumatic conveying dryer. The reason for the choice was the smaller toxicity and explosion risks with the vacuum rotary dryer. The operating cost of combined drying and grinding with the vacuum rotary would be about $4,000 less annually than with the pneumatic conveying dryer.

TABLE 7—PRELIMINARY COST ESTIMATE FOR EXAMPLE 2

Type of Dryer	Installed Cost, $	Operating Cost, $/100 lb
Vacuum tray	30,000	2.23
Agitated-pan	35,000	2.18
Vacuum rotary	40,000	1.43
Screw conveyor	20,000	1.39
Vibrating tray	40,000	1.48
Pneumatic conveying	16,000	1.89

TABLE 8—FINAL COMPARISON OF COSTS FOR EXAMPLE 2

Item	Vacuum Rotary Dryer	Pneumatic Conveying Dryer
Space required, ft	6 x 25 x 8	12 x 12 x 12
Purchase cost, including auxiliaries, $	31,400	15,500
Installation cost, $	11,400	10,000
Total installed cost, $	42,800	25,500
Operating costs, $/100 lb		
Steam	0.033	0.130
Electricity	0.033	0.080
Labor	0.237	0.493
Maintenance	0.344	0.129
Depreciation	0.302	0.181
Losses	0.015	0.672
Total operating costs	0.964	1.685

Example 3

Conditions—Cellular blocks, 8 ft x 6 ft x 1 ft, of an organic material are to be dried at the rate of 100 blocks per day. The maximum allowable temperature for any extended period of time is 180F, although slightly higher temperatures can be used for short periods. Since this material is sold by volume, it is desirable to keep shrinkage of this substance to a minimum.

Preliminary Selection — From Tables 2 and 4, the dryers which appear applicable are tray, tunnel, vacuum tray, and dielectric. Since the number of dryers is small and since shrinkage is so important, the preliminary cost comparison can be eliminated.

Drying Tests—Drying tests were conducted in only 3 semi-works dryers since test data in tray dryers can be extended to tunnel dryer design. The results follow:

Tray Dryer—Total drying time at 180F was 20 hours. Shrinkage amounted to 15% by volume during drying.

Vacuum Tray Dryer—Total drying time at 26 inches of vacuum was found to be 16 hours with a shelf temperature of 180F. Shrinkage amounted to 13% by volume during drying.

TABLE 6—FINAL COMPARISON OF COSTS FOR DRYERS CONSIDERED IN EXAMPLE 1

Item	Roto-Louvre	Direct Rotary	Pneumatic Conveying	Steam-Tube Rotary	Screw Conveyor
Space required, ft	5 x 12 x 8	5 x 20 x 8	6 x 6 x 8	4 x 12 x 8	3 x 25 x 8
Purchase cost, including auxiliaries, $	6,500	5,000	2,400	4,000	6,250
Installation cost, $	3,000	3,000	2,050	3,000	3,100
Cost of building space for dryer, $	400	800	288	385	600
Total installed cost, $	9,900	8,800	4,738	7,385	9,950
Operating costs, $/100 lb					
Steam	0.0221	0.0250	0.0275	0.0125	0.0142
Electricity	0.0021	0.0021	0.0025	0.0013	0.0042
Labor	0.0833	0.0833	0.0833	0.0833	0.0833
Maintenance	0.0053	0.0044	0.0025	0.0031	0.0104
Depreciation	0.0055	0.0049	0.0026	0.0041	0.0055
Losses	0.0040	0.0040	0.0080	.....	.....
Total operating cost	0.1223	0.1237	0.1264	0.1043	0.1176

TABLE 9—FINAL COMPARISON OF COSTS FOR DRYERS CONSIDERED IN EXAMPLE 3

Item	Tray Dryer	Tunnel Dryer	Vacuum Tray Dryer	Dielectric Dryer
Space required, ft	120 x 40 x 12	120 x 30 x 12	110 x 40 x 12	20 x 30 x 8
Purchase cost, including auxiliaries, $	80,000	60,000	225,000	225,000
Installation cost, $	40,000	35,000	85,000	70,000
Cost for new building, $	55,000	43,000	53,000	.....
Total installed cost, $	175,000	138,000	363,000	295,000
Operating costs, $/100 blocks				
Steam	92.10	80.60	28.80	.....
Electricity	10.07	5.03	22.40	67.20
Labor	96.00	48.00	96.00	48.00
Maintenance	18.17	14.46	66.00	89.80
Depreciation	18.17	14.46	47.10	44.90
Losses	720.00	720.00	624.00	240.00
Maintenance and depreciation on building	12.05	9.42	11.61	.....
Total operating costs	966.56	891.97	895.91	489.90

Dielectric Dryer—Total drying time of 12 minutes required. Shrinkage amounted to 5% by volume during drying.

From these tests all of the dryers appear applicable and quotations are obtained.

Final Selection—Company estimates of installed and operating costs resulted in the comparison given in Table 9. Of the conventional drying equipment, the tunnel dryer is the least expensive, both to purchase and to operate. However, all of the conventional equipment would require a new building to house it and the shrinkage losses would amount to a major fraction of the operation cost. For these reasons the operating cost of the dielectric dryer, which can be installed in the existing building, is substantially less than that of the other dryers. Total operating savings in excess of $100,000 will more than justify the additional $157,000 investment required for the dielectric dryer. It is important to note, however, that the marked decrease in the shrinkage loss was required to justify this expensive equipment.

Example 4

Conditions—Wood chips are to be dried from an initial moisture content of 40% dry basis to 6% moisture at a rate of 750 lb per hr.

Preliminary Selection—Tables 2 and 4 indicate that tunnel, continuous through-circulation, direct rotary, pneumatic conveying, indirect rotary, or screw conveyor dryers might be applicable. Batch dryers are excluded since their operation at the required production levels would be more expensive than continous dryers. Dielectric and infrared dryers are not considered because their high operating cost could never be justified for the low cost product being handled in the process.

A preliminary cost estimate for these dryers is listed in Table 10.

From this comparison, it is apparent that the most promising dryers are the direct rotary, pneumatic conveying, and, indirect rotary dryers. The continuous through-circulation and screw conveyor dryers will probably be too expensive and the tunnel dryer will require more labor than other types, as well as being expensive.

Drying Tests — The following results were obtained in semi-works tests of the 3 dryers under consideration:

Direct Rotary Dryer—A satisfactory product was obtained if parallel air flow was used. A maximum inlet air temperature of 300F could be employed without charring.

Pneumatic Conveying Dryer—Two stages, each 100 ft long, were required to obtain the required final moisture content. A satisfactory product was obtained. Air at 500F could be employed for drying.

Indirect Rotary Dryer—A steam-tube rotary dryer was tested. Even with atmospheric steam in the tubes, some overdrying and charring occurred. This dryer will be unsuitable.

Final Selection — A comparison of the company estimate of operating and investment costs of the two dryers still under consideration is given in Table 11.

From this it is evident that a two-stage pneumatic conveying drying system will be the least expensive to install and operate. In addition, no building space is required to house a dryer of this type, whereas it is generally advisable to protect rotary dryers from the weather.

Example 5

Conditions—A fabric is to be dried after coating. In order to avoid product loss, since it is sold by area, it is essential to keep shrinkage during drying to a minimum. During coating, both sides of the fabric become wet with the coating material. It is necessary that the finish on both sides of the fabric be unblemished.

Preliminary Selection—Reviewing Tables 2 and 4 for the types of dryers which might be used, it is apparent that a direct continuous sheeting dryer will

TABLE 10—PRELIMINARY COST ESTIMATE FOR EXAMPLE 4

Type of Dryer	Installed Cost, $	Operating Cost, $/100 lb
Tunnel	30,000	0.667
Continuous through-circulation	37,000	0.339
Direct rotary	14,000	0.262
Pneumatic conveying	10,700	0.288
Indirect rotary	10,500	0.205
Screw conveyor	36,000	0.317

be required. The most suitable dryer of this class is the tenter dryer, since it allows the material to be dried without contact with foreign surfaces which might blemish the finish and it prevents both length- and width-wise shrinkage during drying. The only question which remains to be settled is the exact size of the tenter dryer and which of the many vendors should be selected to supply it.

Drying Tests—Drying tests were run in one or two vendors' laboratories to determine the optimum drying temperature and air velocity for drying. These tests indicate that the fabric can be satisfactorily dried. Selvage losses should be less than 1%. Drying without tension results in shrinkage losses up to 8%, so the 1% selvage loss can be justified.

Final Selection—Quotations were obtained from a number of vendors and the least expensive dryer having all the desired operating features was selected.

Example 6

Conditions—A complex mixture of solid organic compounds is to be recovered from a water solution. The solution can be concentrated to 20% solids by weight in an evaporator. Further evaporation causes crystallization of some of the compounds in the solution, which is undesirable.

Preliminary Selection—Tables 2 and 4 indicates that either a spray dryer or a drum dryer might be applicable. In addition, since product quality and solubility are important, it is possible that sublimation drying might be applicable. Vacuum tray dryers would be used on frozen solution to dry by sublimation. Since the number of applicable dryers is limited and since product quality is so important, all of these dryers should be tested.

Drying Tests—The following are the results of the drying tests in semi-works models of the dryers under consideration:

Drum Dryer—A satisfactory, soluble, dry product was obtained which was somewhat dusty. Bulk density of the product was found to be 22 lb per cu ft. Losses during drying were negligible.

Spray Dryer—A satisfactory dry product, slightly more rapidly soluble than the drum-dried product, was obtained. The dry material was somewhat less dusty than the drum-dried material. However, a bag collector will be necessary to prevent excessive product loss. Bulk density of dry material was 13 lb per cu ft.

Sublimation Dryer — A rapidly soluble product was obtained which seemed to be about 3% stronger in potency than either the spray- or drum-dried product. Bulk density of dry material was 15 lb per cu ft. A drying time of 36 hours was required.

From these tests, any of the dryers appear to be suitable to handle this material.

Final Selection—Quotations from vendors of the equipment being considered were obtained and the cost estimates were listed in Table 12.

This tabulation indicates that drum-drying is the least expensive method for handling this product. Not only are the equipment and operating costs less for this method than the others, but the packaging cost is substantially less. The slower solubility and somewhat dusty nature of the product is not considered a serious drawback with the drum-dried product, so this method will be adopted. It is interesting to note that sublimation-drying costs about 5—7 times as much as the other methods. However, the 3% increase in potency obtained with this high cost product almost made this method of drying competitive. If a marked increase in strength had been obtained, this method of drying would have looked very attractive.

TABLE 11—FINAL COMPARISON OF COSTS FOR EXAMPLE 4

Item	Direct Rotary Dryer	Pneumatic Conveying Dryer
Space required, ft	6 x 30 x 12	None enclosed
Purchasing cost, including auxiliaries, $	7,400	4,175
Installation cost, $	3,400	1,500
Total installed cost, $	10,800	5,675
Operating costs, $/100 lb		
Steam	0.120	.....
Fuel	.....	0.050
Electricity	0.016	0.018
Labor	0.110	0.110
Maintenance	0.018	0.008
Depreciation	0.009	0.005
Total operating costs	0.273	0.191

TABLE 12—FINAL COMPARISON OF COSTS FOR EXAMPLE 6

Item	Drum Dryer	Spray Dryer	Sublimation Dryer
Space required, ft	20x30x12	20 x 20 x 20	50 x 50 x 12
Purchase cost, including auxiliaries, $	42,000	44,000	125,000
Installation cost, $	12,000	19,000	75,000
Cost of building space, $	7,200	8,000	30,000
Total installed cost, $	61,200	71,000	230,000
Operating costs, $/100 lb			
Steam	0.780	1.127	1.00
Electricity	0.050	0.133	1.50
Refrigeration	.....	.....	10.00
Labor	0.667	0.667	1.33
Maintenance	0.450	0.262	1.04
Depreciation	0.360	0.419	1.67
Total operating costs	2.307	2.608	16.54
Packaging costs, $	1.430	2.420	2.10
Total finishing cost, $	3.737	5.028	18.64
Value of increased potency, $	.....	.....	12.00

Generalizations

The preceding examples indicate some of the problems which are encountered in the evaluation of dryers for a specific drying job. After a number of such evaluations have been made, a few generalizations become apparent. As with all generalizations, there are numerous exceptions and they should therefore be

use judiciously. Some of these generalizations are:

(1) Tray dryers, although costly at high production levels, will generally be no more expensive than other dryers at production levels of about 40 lb per hour of product or less.

(2) Except where temperatures in excess of 1,000F can be used, and at production levels of less than about 40 lb per hour, steam-tube rotary dryers are usually the least expensive of all of the dryers to install and operate.

(3) Screw conveyor dryers are generally applicable only to drying materials containing 35% moisture or less.

(4) Hot air rotary dryers and conveying-screen dryers are comparable in cost when operating at steam temperatures and are only slightly more expensive than steam-tube dryers.

(5) Pneumatic conveying dryers are least expensive at high production levels. At evaporation rates exceeding 1,000 lb per hour they are directly competitive with and often less expensive than other methods of drying. They are generally applicable only to materials containing surface moisture.

(6) Drum dryers and spray dryers will cost about the same. Spray dryers will be less expensive at evaporation rates in excess of about 1,000 lb per hour, and drum dryers will be less expensive at the lower rates.

(7) Vacuum rotary dryers are the least costly of batch dryers at high production levels. When solvent recovery is a problem, they are often less expensive than continuous dryers.

(8) Infrared is most useful as a booster for more conventional dryers, but will often be competitive when drying thin films of material.

(9) Drying by sublimation and dielectric drying will usually only be competitive when marked quality improvements can be obtained by these methods. The latter method is most useful when handling bulky materials which will take a long time to dry by conventional methods.

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Heating and Ventilating Industry Holds Convention and Show

Following is an account of activities at the 57th annual meeting of the American Society of Heating and Ventilating Engineers and the 10th International Heating and Ventilating Exposition which opened simultaneously in Philadelphia, January 22. Important papers presented at technical sessions are reviewed. New equipment introduced at the Exposition is covered in News of Equipment and Materials, beginning on page 119 of this issue.

ADVANCE contingents of an annual congregation of authorities in the art and science of making man comfortable indoors began to arrive in Philadelphia Sunday, January 21 for the 57th annual meeting of ASHVE and the 10th International Heating and Ventilating Exposition, which opened January 22. By the end of the week a record attendance of 1,700 members and guests had registered at the Society convention at the Bellevue-Stratford Hotel and 18,000 registered spectators had viewed exhibits at Philadelphia's Commercial Museum.

Hosts for the meeting were members of the Philadelphia Chapter of ASHVE with A. J. Nesbitt, president of John J. Nesbitt, Inc. in Philadelphia, acting as general chairman of the committee on arrangements. M. F. Blankin, president of Blankin Equipment Corp. was honorary chairman.

A wide variety of topics was covered at technical sessions in a program of 17 papers and a symposium. Among subjects covered were combustion, smoke measurement, air cleaning, heat pump performance, snow melting, steam heated structures, transportation heating and controls, solar radiation, axial flow fans, and panel heating and cooling. Abstracts of papers follow this report.

Lester T. Avery, president of ASHVE, opened the first session Monday morning which covered various aspects of panel heating. A symposium on man and his relationship to air took place on Wednesday with Nathaniel Glickman, assistant professor of medicine and research physiologist at the University of Illinois Medical School, acting as moderator. Participating were Dr. Eugene F. DuBois of Cornell University; Dr. Robert W. Keeton of the University of Illinois; Charles S. Leopold, consulting engineer of Philadelphia; Capt. Oscar Schneider from the U. S. Naval Medical Corp., and Theodore F. Hatch of the University of Pittsburgh and Industrial Hygiene Foundation.

The physiological aspects of air conditioning were covered in a group of papers.

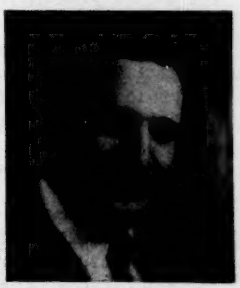
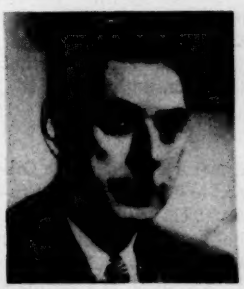
At the annual banquet, held on Wednesday evening, Cameron Ralston, past director of public forums, Office of Education, U. S. Department of the Interior, spoke on "The Plagues of Democracy." Samuel R. Lewis, consulting engineer, Chicago, was presented with the F. Paul Anderson medal.

Various social events had been arranged for members and guests, including special events for ladies. A ladies' tea with entertainment was held Monday afternoon at John Wanamaker's. A Monday evening event called "A Night with the Pennsylvania Dutch" included a buffet supper featuring Pennsylvania Dutch dishes and a Dutch play, "Poppa is All."

Officers

Officers elected to serve ASHVE during 1951 were: President, Lauren E. Seeley, dean of the College of Technology and director of the Engineering Experiment Station, University of New Hampshire; first vice president, Ernest Szekely, president of the Bayley Blower Co.; second vice president, Reg. F. Taylor, consulting engineer of Houston, Texas; treasurer, Howard E. Sproull, division sales manager, American Blower Corp. Installation of officers was on Thursday at the concluding session of the meeting.

Dean Seeley was born in Meriden, Conn., November 8, 1898. He attended Yale University where he received his Ph.B. degree in 1921, his M.E. in 1924, and LL.B. in 1935. While preparing for his degree he took courses in mechanical engineering at Yale and

Newly elected officers of the ASHVE are, left to right: President, Lauren E. Seeley, dean of the College of Technology, University of New Hampshire; first vice president, Ernest Szekely, president, Bayley Blower Co.; second vice president, Reg. F. Taylor, consulting engineer, Houston, Tex.; treasurer, Howard E. Sproull, division sales manager, American Blower Corp.

in 1925 was put in charge of a course in heating and ventilating. He remained at the University until 1945 when he was appointed to his present position at the University of New Hampshire.

Mr. Szekely was graduated in 1910 from the University of Budapest with a M.E. degree and then joined the teaching staff. In 1912 he became associated with Jeffrey Manufacturing Company and Guarantee Construction Company, New York. In 1914 he joined the staff of the American Blower Co., Detroit, as research engineer and in 1928 he became chief engineer of the company he now heads.

Reg. F. Taylor was born in Toronto, Canada, and educated in public and preparatory schools in England and South Africa. He came to the United States in 1908 and served in several architectural and engineering firms before opening his own office as a consultant.

H. E. Sproull, a graduate of Purdue University, first became associated with the American Blower Corp. in 1911 and has since been sales engineer and manager of several of their branch offices.

The society also announced new 3-year members of the council, governing body of the ASHVE. They are: John H. Fox, sales manager, Minneapolis-Honeywell Regulator Co., Ltd., Toronto, Canada; L. N. Hunter, vice president of research, National Radiator Co.; Neil H. Peterson, president, Neil H. Peterson Co., San Francisco; Benjamin S. Spurlock, Jr., associate professor of mechanical engineering, University of Colorado.

The 1951 Committee on Research will include five new members elected for a 3-year term. They are as follows: A. B. Algren, University of Minn.; John Everetts, Jr., consulting engineer with Charles S. Leopold of Philadelphia; T. H. Smoot, director of research, the Lennox Furnace Co.; T. A. Walters, director of research, American Blower Corp.; W. N. Witheridge, ventilation consultant, General Motors Corp.

Exposition

The 10th International Heating and Ventilating Exposition opened in the Commercial Museum at 2 pm January 22. All available exhibit space was occupied to show a wide variety of new products in the largest display of heating, ventilating, and air conditioning equipment ever held. Products introduced at the show are described in the News of Equipment and Materials section of this issue. Exhibits demonstrated fuel conservation, year-round air conditioning, air purification and handling. The exposition is under the direction of Charles F. Roth and E. K. Stevens.

Following is a series of abstracts and important technical papers delivered at the convention.

Rating Fuel Oils

A fuel combustion test unit was designed by the Oil-Heat Institute of America, Inc., to determine the burning characteristics of fuel oils. Tests were conducted at the ASHVE Research Laboratory to see the extent to which the fuel oil combustion test unit could be used to distinguish between and reproduce the burning qualities of different fuels as indicated by smoke density and flame length at a given CO_2 percent. The findings were reported in a paper on Rating of Fuel Oils by a Test Unit, by David W. Locklin and George V. Parmelee, members of the ASHVE Research Laboratory staff. The unit consists of a pressure atomizing type burner firing axially into a cylindrical water jacketed combustion chamber, a portion of which is lined with refractory material. The nozzle produces a hollow cone spray. Flame length could be determined by adjusting a movable water-cooled baffle.

Five of six oils tested gave satisfactorily reproducible results. Following are some of the conclusions arrived at as the result of the study:

1. In addition to increasing the firing rate, the effect of increasing the delivery pressure of the oil was to produce cleaner combustion and a slightly shorter flame.

2. At constant air-fuel ratio, the effect of decreasing the air shutter opening was to reduce smoke density and flame length, while increasing percent CO_2.

3. The effect of switching the ignition off during steady operation was to increase the air supply rate and to increase smoke production.

4. Smoke densities during shutdown were greater than during starting, and smoke densities during starting were generally higher than during steady operation.

5. A good degree of correlation was obtained between test results at similar firing rates and the following combustion indices: API gravity, hydrogen-carbon ratio, diesel index and burning index. A greater number of oils must be investigated if these correlations are to be so established that a simply obtained index can be used to rate the burning qualities of fuel oils. Investigation should be made to determine whether these correlations may be extended to other types of burners and to field installations.

6. To determine the significance of the results obtained with the test unit, it would be desirable to investigate fundamental principles of fuel atomization, ignition, air-fuel mixing, and smoke measurement.

Earth Heat Exchangers for the Heat Pump

A theoretical discussion of the Theory of Earth Heat Exchangers for the Heat Pump was presented by I. R. Ingersoll, professor of physics and F. T. Adler, assistant professor of physics, and A. C. Ingersoll, project assistant, all with the University of Wisconsin and H. J. Plass, research assistant, Stanford University. The authors developed the theory for plane exchangers, cavities, long and short pipes and various pipe grids for both conditions of constant exchanger temperature and constant transfer rate. In the paper consideration is given to the effects of summer recovery, ice formation, moisture migration and underground water movement.

As a result of this study, the following conclusions were announced:

1. Planar exchangers and (roughly spherical) cavities are both inferior to the relatively isolated pipe, on the basis of exchanger rate per unit area.

2. On this same basis a small pipe is more efficient than larger ones.

3. In the matter of pipe grids, such forms as flat

grids, star grids, and closely-wound pipe helixes are all of questionable efficiency. A hairpin loop with the two parts well apart in a trench should show good efficiency, which would be lowered, however, for two such loops in the same trench. The long pipe with many short laterals is worth consideration and the grid made up of vertical well-separated pipes has good possibilities.

4. Lack of ground temperature recovery in summer need not be a concern unless a large block of ground deeper than some 20 ft has been cooled by winter operation.

5. Freezing of moist soil about the exchanger pipe will retard the cooling of the pipe somewhat, but the effect is not large, being of the order of approximately 10%, which accordingly will increase only slightly the efficiency of winter operation.

6. The effect of moisture migration to the cold pipe will increase the soil conductivity and accordingly lessen the temperature gradient near the pipe and therefore lessen the pipe temperature differential. This would tend to increase heat pump efficiency.

7. Underground water movement becomes of notable importance only when the velocity exceeds 0.01 ft per hr.

Ground Grid Design for Heat Pumps

To supply some of the information most necessary in ground grid design as related to the heat pump, George S. Smith, professor of electrical engineering, University of Washington, conducted an investigation and reported his findings in a paper on Factors Useful in Ground Grid Design for Heat Pumps.

Ground grids have often partially or completely failed to provide adequate returns because of improper size or design. The ground grid presents a new field of heat exchange design and little is known of the factors involved.

While accurate information for ground grid design is very difficult to obtain, and many assumptions must be made, the results definitely indicate, according to Prof. Smith, that the average city lot is too small to support the house usually built thereon. Thus, the ground grid is practicable only where larger lots are available, or where very special soil, moisture and subsurface conditions are found. Soil densities and conductivities should be carefully chosen, since the soil around a newly installed grid may require years to attain its original density. The use of vertical tubes in holes dug quite deep can be used if the spacing and number are such that a sufficient volume is uniformly drawn upon.

While the greater depths may draw on greater volumes, if the heat is not returned each season, the design is in danger of ultimate failure unless moisture migration at these greater depths assists by drawing from neighboring areas.

Sidewalk Snow Melting

Nine prefabricated pipe grids were installed in a sidewalk snow melting installation in Detroit. A study of actual operation was made and the results reported by L. A. Stevens, technician, and G. D. Winans, assistant superintendent, Central Heating Department, The Detroit Edison Co., in a paper, Operating Experience and Data from a Sidewalk Snow-Melting System. The paper covered a description of the system and method of operation, and includes a bibliography of articles published on snow melting for each year from 1944 through 1949. The following conclusions contain interesting comments regarding design and operation:

1. There is no need to provide drainage for the melted snow.

2. Solution heaters should be capable of condensing 0.4 or 0.5 lb of steam per hour per square foot of sidewalk surface.

3. Steam and electric consumptions are reasonable.

4. Although not determined in this test, it is obvious that where salt is used to melt ice and snow on sidewalks bordered by grass or shrubs, a snow melting system would eliminate the need of the salt which would be injurious to plant life.

5. It is desirable to operate the snow melting systems only when there is snow on the walk or when snow is falling.

6. There is a need for a simple control which would start operation of the system when a snowfall begins and turn it off when the snowfall is ended and the sidewalks are free of snow.

7. A snow melting system insures cleanliness in entrances and lobbies during snowfalls.

Effective Heat

As the result of a test program suggested by the Engineering Committee of the Convector Manufacturers Association, tests were conducted at the Sibley School of Mechanical Engineering at Cornell University to determine the condensate necessary to heat a structure to a given condition when using devices of different outlet air ejection heights and locations, and to determine a new standard against which to compare the performance of the convectors.

Results are presented in a paper, Principles of Effective Heat for Steam Heated Structures, by C. O. Mackey, professor of heat power engineering and N. R. Gay, associate professor of heat power engineering, Cornell University; R. D. Tutt, chief engineer, Tuttle & Bailey, Inc.; E. G. Powell, chief engineer, C. A. Dunham Co.; and E. L. Broderick, consultant to the Engineering Committee of CMA.

The authors presented results of tests of a large number of heating units and also a proposed table for effective heat allowance to be applied to convectors. For each unit tested, there was one point of temperature measurement in the room, corresponding to the least condensation from the heater while maintaining the desired temperature at this point. This point was found to rise with the height of heater or heater air outlet, and it varied somewhat in position depending on the construction of the heater.

From test results, the authors concluded that for the same outdoor temperature and infiltration and the same structure, the room heat loss, based on average temperature at all levels in center of room, may vary with different heaters while maintaining the same average temperature.

All radiators, convectors and baseboards were tested in the cold room of the Sibley School of Mechanical Engineering at Cornell University in accordance with a procedure that complied with Commercial Standard CS140-47.

Building Papers and Sheet Materials

A paper on Water-Vapor Permeability of Building Papers and Other Sheet Materials was prepared by E. R. Bell and M. G. Seidl, physicists, and N. T. Krueger, physical science aid, all with the Forest Products Laboratory, University of Wisconsin.

The water-vapor permeability of 100 building papers and other sheet materials was determined. Materials tested were largely paper-base compositions treated in various ways to make them resistant to the passage of water vapor.

The test chamber was equipped with a sensitive thermostat and wood-element hygrostat that held both dry and wet bulb temperatures within very small variations. Pans were weighed in an enclosure in the chamber to maintain test chamber conditions during weighing and to exclude air currents. A special method of sealing the specimens over wet pans was developed and described in the paper.

In this investigation, the water-vapor permeability was determined according to Tentative Standard Procedure C21[4]-47T prepared by Committee C-16 of the American Society for Testing Materials. Both the dry and wet methods were used, although, generally, the wet method gave values somewhat higher than those found by the dry method under the same conditions of temperature, air velocity, and vapor pressure difference through the samples, but the ratio between them was not even approximately constant.

The very large range of permeability values presented indicates that the tests included materials of both very low and very high permeability. It also revealed the magnitude of variations between different samples of the same material.

Aircraft Propellers for Axial Flow Fans

Scale models of 2-, 3-, and 4-blade aircraft propellers were installed in ducts and tested for performance as axial flow fans. The data obtained were presented in a paper, Use of Aircraft Propellers for Axial Flow Fans, by Elmer C. Lundquist, professor of mechanical engineering, University of Iowa; and M. J. Hamilton, air conditioning design engineer, Douglas Aircraft Co.

The authors claim that the performance of a fan of any size may be predicted by the method presented, if information is available for any geometrically similar fan. Equations were developed for help in selecting fans for a required performance.

Results of the model tests can be expected to be applicable to prototype fans so long as the tip speeds do not exceed $39\sqrt{T}$ fps where T is the air temperature in Rankine degrees. In making this statement, it was assumed that the effect of variation of the Reynolds number of flow around the propeller blades has a negligible effect on fan performance.

Examples were worked out to show how a propeller may be selected for a specified air capacity and pressure rise. Also shown was how to determine the blade angle setting and the horsepower required for a specific set of operating conditions.

It is suggested that the methods used in this study might be employed whenever the performance of any fan might be required and it is not feasible to test the prototype. Data given are limited to the case of a propeller mounted in a round duct without hub fairing or guide vanes.

Roof Spray for Heat Reduction

Experiments were conducted to study the effectiveness of roof sprays as a means of limiting surface temperatures of roofs that are exposed to solar radiation, in a study made by G. E. Sutton, assistant in research, Engineering and Industrial Experiment Station, University of Florida. His findings were reported in a paper, Roof Spray for Reduction in Transmitted Solar Radiation and showed that the surface temperature of a roof which would reach 150F under maximum solar intensity if unsprayed, could really be maintained at 100F when sprayed.

As an appendix to the paper an empirical equation is presented to predict heat flow through various types of roofs.

It was found that water pools 2 and 6 inches deep would maintain a surface temperature of 108F and 103F, respectively. Other findings follow:

1. The higher the surface temperature that may be tolerated, the more efficiently will the spray system operate, since more of the evaporative effect may be utilized.

2. Sprays are more effective than pooled water for cooling roofs.

3. Temperatures and comfort conditions within a space below a sprayed roof are desirably affected by spraying.

4. Some reduction in surface temperature of the walls of the building is produced by the spillage of cooled air from the roof.

5. Spray water has a preservative effect on asphalt types of roofing by reducing temperature change and lowering surface temperatures. There is, consequently, less thermal stress, less vaporization of volatile oils than for unsprayed roofs and there is no thermal shock from sudden thunderstorms.

6. Addition of insulation will decrease heat transmission, but will cause an increase in surface temperature, thus adding a deteriorating effect to some types of roofing.

7. Installation of sprays on conditioned buildings may serve to reduce the required refrigeration capacity, and thus present a saving in the cost of materials and installation.

8. The spray system, though simple in design, presents an efficient and economical means of reducing the effects of incident solar energy on roofs.

Solar Energy Transmittance Through Glass

George V. Parmelee and Warren W. Aubele, staff members of the ASHVE Research Laboratory, pre-

pared a paper on Solar Energy Transmittance of Figured Rolled Glass which contains data for seven patterns of figured or patterned glass. The information given is considered of practical use in calculating solar heat gain.

It was found that even simple patterns greatly reduced transmittances, particularly at the higher angles of incidence, as compared to polished sheets of similar composition. Etching for reducing glare further reduces transmittance.

The authors presented a number of graphs to show the transmittance of direct solar radiation for various types of glass.

Transportation Air Conditioning

Norman O. Kirkby, executive engineer, Vapor Heating Corp., in his paper on Transportation Heating and Air Conditioning Systems and Controls presented an inside view of the problems that engineers had to meet and how they were solved. He covered the fields of railroad cars, buses and aircraft applications, describing the steam generator, system for waste heat recovery and systems designed for buses.

The heating system of a railroad car may be divided into an overhead forced air system, a side wall radiation system, and the radiant heating at the floor line. In air conditioning, the most widely used system employs electro-mechanical equipment.

Buses normally make use of the waste heat from the engine, and the heated coolant is pumped through various types of radiation. Street cars of the PCC type use heat from dynamic brakes and by means of thermostatically controlled dampers, either reject the heat or admit it into the car body. Aircraft are heated and cooled through the use of mixing dampers to correctly proportion hot and cold air.

Mr. Kirkby pointed out that while the field of transportation heating, ventilating and air conditioning is not a highly competitive high mass-production industry, it has kept pace with the most forward thinking and it has offered important contributions to the general knowledge of such subjects. It is expected that as transportation develops, so will the advances in these fields.

Panel and Air Cooling Systems

In a paper on Design Factors in Panel and Air Cooling Systems, by Charles S. Leopold, consulting engineer, an attempt was made to present the theory of panel and conventional air cooling systems and to indicate possible courses of panel cooling design.

Included in the paper is an appendix which contains data on panel performance for a suspended ceiling consisting, in part, of cooling panels and, in part, of perforated metal in conjunction with sound-absorbing pads.

Theoretical considerations, supported by tests, indicated that it was not necessary to cool the entire ceiling panel to utilize coolant temperatures safely above the dew point. Cooling panels can be perforated to allow for sound-absorbing media above without materially affecting their thermal performance.

The authors pointed out that in comparing air conditioning methods, it is essential that the methods under consideration shall not produce an end result which will unduly compromise with the production of optimum conditions. Assuming that the air conditioning methods to be compared are capable of attaining the same end result, the selection of a particular form of air condition is a matter of economics. The air conditioning design should be related to all elements of building construction and use, and the economics be determined not solely on the owning and operating cost of the air conditioning but on the owning and operating cost of the entire building.

Electrostatic Precipitation

A short historical outline of the development of electrostatic precipitation was presented in a paper, A Survey of Electrostatic Precipitation, by Eric A. Walker, director of Ordnance Research Laboratory and head of the electrical engineering department, and John E. Coolidge, associate professor of engineering research, both of The Pennsylvania State College.

The authors reviewed the mechanism of electrostatic precipitation. They pointed out that while theories have been advanced for a number of specific processes, none of these theories does, or can, completely account for all phases of the problem. To date, some factors apparently have not been considered. A table is included which gives a comparison of particle charging theories in a corona discharge, and mathematical equations for the maximum charge, time to charge, and transport time.

Further study is required for an adequate understanding of the effects of the resistivity of the deposit on precipitation of various materials. It appears increasingly evident that the action at the collector plate is the limiting factor in many installations.

Symposium – Man and His Relationship to Air

A symposium on Man and His Relationship to Air was held under the chairmanship of Nathaniel Glickman. Papers presented at this symposium covered physiological aspects of heating and ventilating, a historical resume of the development of comfort data, a report on studies of hot industries, an analysis of air conditioning in the treatment and prevention of disease, and a resume of blast and radiation effects following atomic explosions.

Eugene F. DuBois, M.D., New York, discussed the physiological changes occurring over a wide range of environmental conditions.

The engineering aspects of comfort data and the historical background of the compilation of existing data were covered by Charles S. Leopold, consulting engineer, Philadelphia.

Theodore F. Hatch, Professor of Industrial Health Engineering, University of Pittsburgh, reported on observations made in the hot industries and pointed to the basic difference between the psychological nature of comfort requirements and the physiological nature of the limits of human tolerance for heat.

Dr. Robert W. Keeton, Chicago, who discussed air

(Continued on page 151)

Methods for Supporting Pipe

J. E. YORK
Building Service Engineer, Stone & Webster Engineering Corp.

Part 10 of a group of articles that describes and illustrates the various means for supporting pipe lines. This article, the final of the series, covers supports for outdoor pipe lines.

FOR manufacturing plants and for other industrial purposes, it is frequently necessary to install piping between buildings which are some distance apart. While it is desirable to consider the general appearance of such plants, the cost of providing tunnels for the piping would in many cases be prohibitive and could not be justified economically. It is therefore necessary to install the pipe above ground. In such cases it may be possible to run the pipe just above ground level on concrete supports installed at suitable intervals determined by the size of pipe, the type of joints, the material of which the pipe is constructed,

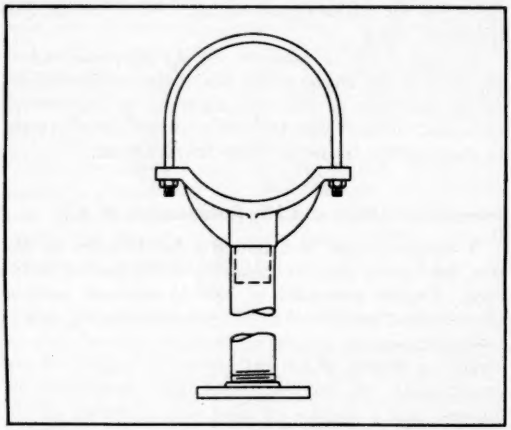


Fig. 133. Pipe stanchion saddle for supporting one pipe line.

and the service for which it is to be used. If, however, the pipe must cross railroad tracks, roadways, trucking or parking areas, it will generally be necessary to install the pipe overhead at sufficient height to maintain suitable clearance space below the lowest part of the supporting structure where it crosses such spaces.

Vertical Supports

Where vertical supports can be used, they may be constructed of structural steel, old rails, pipe, or even of suitable wood posts. In any case, they should be spaced to provide adequate support, without excessive cost, under all the conditions that may reasonably be expected.

Suitable foundations, generally of concrete, should be provided to prevent settling or leaning of the supports, and precautions should be taken to guard against corrosion of steel or rotting of wood supports at or near the ground level.

Single pipes may be supported on pipe stanchion saddles, as shown in Fig. 133, and where several pipes are to follow the same path, cross-bars may be provided and the pipes supported from them, as indicated in Fig. 134.

Support Spacing

Approximate maximum spacing between pipe supports was suggested earlier in this series, but where the economical spacing of the pipe supports is of major importance, it is suggested that a careful analysis of the stresses developed in the pipe line be made. The three criteria commonly used for determining the spacing of pipe supports are deflection, slope, and stress. It is now suggested by an engineer* of extensive experience in this field that the first of these does not give a rational basis for design, and the second is not usually the limiting factor.

*Theodore E. Bridge, Mechanical Engineer with the University of Chicago, in connection with a project under construction for the Argonne National Laboratory.

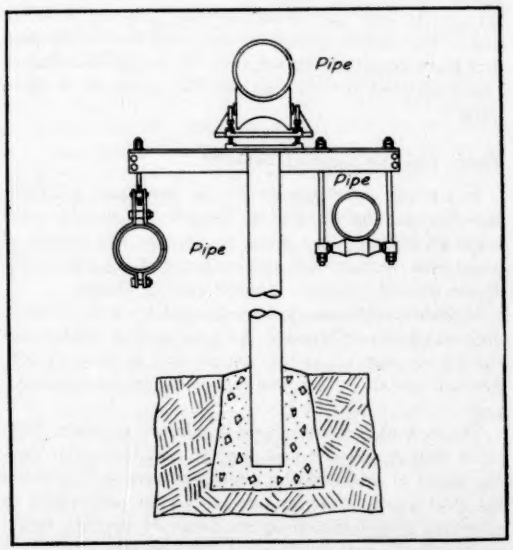


Fig. 134. Cross-bar arrangement for supporting several pipes.

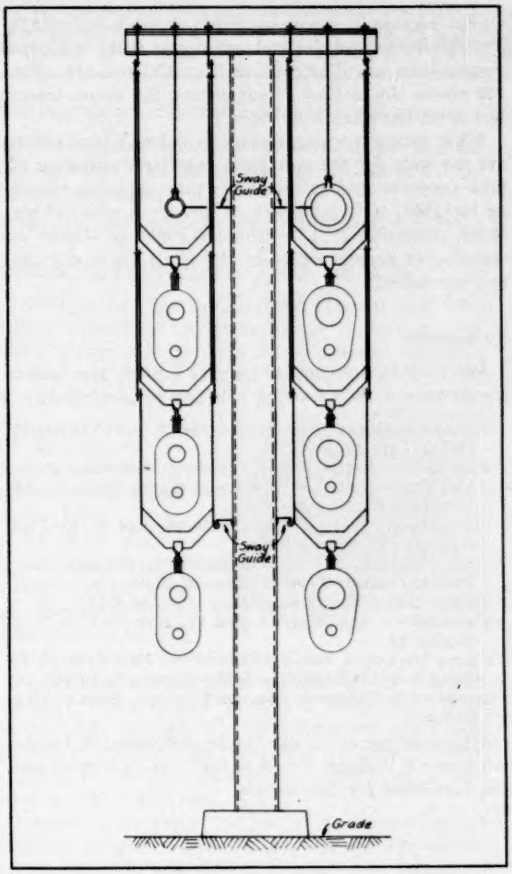


Fig. 135. Pipe bracket with sway bracing. For detail of sway guide see Fig. 137.

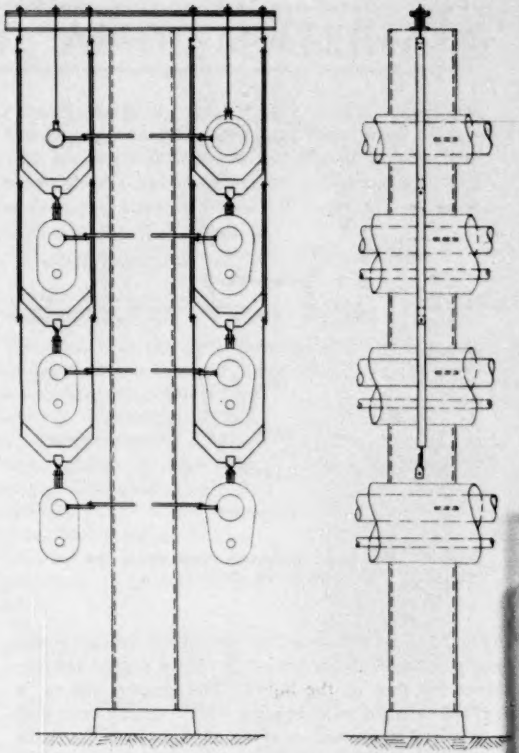


Fig. 136. Method of using anchors with pipe bracket. For details of bracket see illustration below. All illustrations on this page show installation of pipe for steam traced lines.

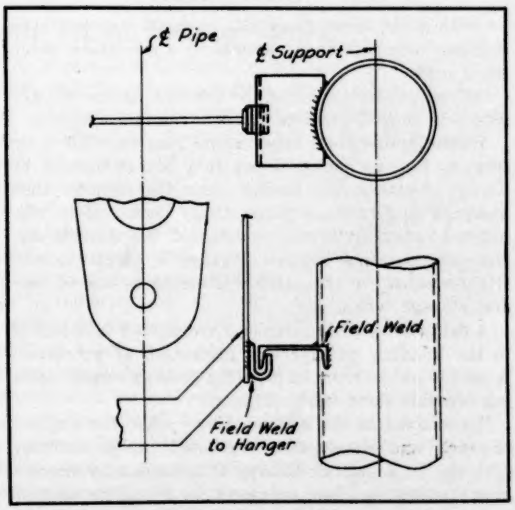


Fig. 137. Detail of sway guide shown in Fig. 135.

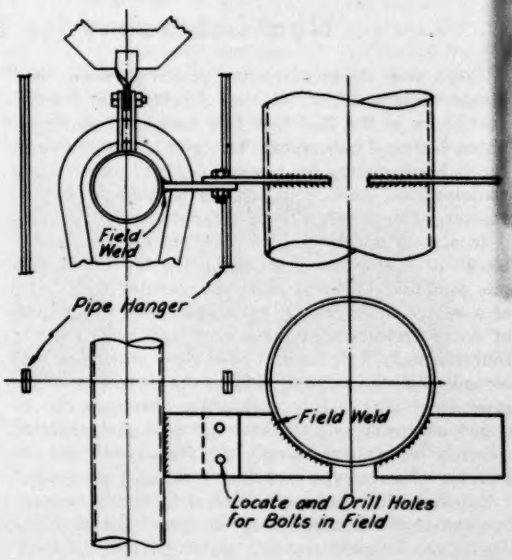


Fig. 138. Detail of anchor shown in Fig. 136.

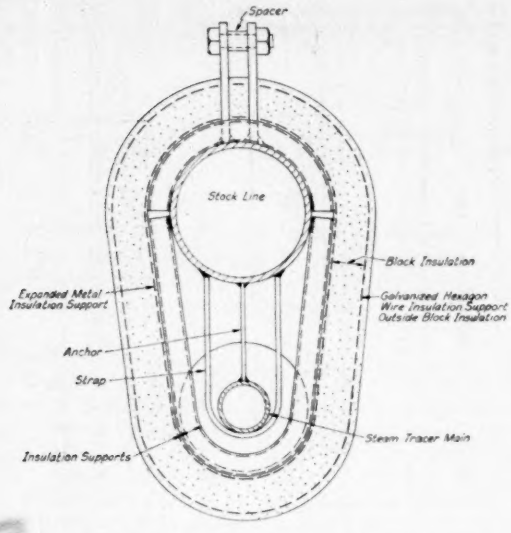


Fig. 139. Method of supporting steam tracer line from stock line above.

Fig. 135 and 136 show the method of installing pipe lines which are steam traced to insure proper temperatures for flow of the liquid. The support shown in Fig. 135 calls for sway bracing which on long lines may be required to prevent swaying of pipes in high winds. Anchors should be provided as shown in Fig. 136 at changes in direction and at other points where required because of expansion joints or bends in the lines. Details of sway guides and anchors at these supports, respectively, are illustrated in Fig. 137 and 138. Fig. 139 shows the method of supporting the steam tracer line from the stock line above.

When pipes cross roadways or railroad tracks that are too wide for the maximum permissible spacing of pipe supports, and intermediate pipe supports cannot be installed, it is necessary to provide a pipe bridge. When designing such a bridge a walkway should be included to permit access to the pipes for inspecting and servicing.

References

For further information on this subject, the reader should consult the following catalogs and bulletins:

Grinnell Company, Inc., Providence, R. I. — Fabricated Piping Data Book
Blaw-Knox — Power Piping Division, Pittsburgh, Pa. — Flex-Anal Charts and Functional Spring Hangers and Vibration Eliminators
Fee & Mason Manufacturing Co., Manasquan, N. J.—Pipe Hangers and Accessories
Crane Company, 836 S. Michigan Ave., Chicago, Ill.—Valves, Fittings, Pipes, Fabricated Piping
Braman Dow & Co., Boston, Mass.—Catalog K-10
Walworth Co., Inc., 60 East 42nd St., New York, N. Y.—Catalog 42
Piping Specialties, Inc., 114 Liberty St., New York, N. Y. Bulletin Guide-Anchor-Guide for Expansion Joints
Carpenter & Patterson, Inc., East Boston, Mass. — Pipe Hangers

Acknowledgement is also made to Sargent & Lundy and Stone & Webster Engineering Corp., for information furnished for this article.

New Laboratory for Processing "Hot" Atoms

Giant steel doors seal off experiments with "hot" atoms while scientists observe developments through periscopes in the Hot Lab just completed at Brookhaven National Laboratory. This new laboratory building is headquarters for processing "hot" materials, or radioisotopes, emerging from the Brookhaven pile, or reactor, after bombardment by neutrons.

In a room which might be thought of as a "prison block" of 3 cells for imprisoning the hottest of such pile products, 11-ton steel doors, operated by the flip of a switch, slide silently open and closed. Each pair of doors encloses a stainless steel cell backed up by concrete walls 3 ft thick. Each door will close in 5 seconds and stop automatically at the correct spot. An experiment with highly radioactive chemicals can be sealed off inside one of these hot cells and operated remotely by controls outside the doors, while the researcher observes the experiment through periscopes.

Experimental equipment exposed to highly radioactive substances is taken to a "clean-up" decontamination room. To make cleaning easier, part of the room is lined with stainless steel, part with tile. When necessary, intensive scrubbing, with soap and water or with acids, takes place in a polished stainless steel dunking tank 5 ft deep, resembling a miniature swimming pool.

All the ventilating air in the Hot Lab passes through filters to remove possible airborne contamination.

Waste liquids from experiments pass through drain lines to hold-up tanks, where they are monitored by Geiger counters and similar detection devices, then analyzed to determine radioactivity levels. If no significant radioactivity can be detected, the waste is discharged in normal manner through a regular sewer. Other wastes are treated and diverted to one of several storage tanks.

A detachment of the Health Physics staff is assigned to the building to supervise protection of personnel. A double locker room is provided to keep street clothing separate from work clothing.

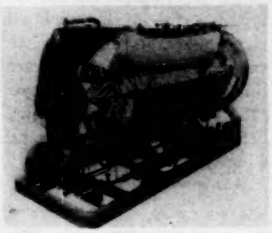
Brookhaven is the northeastern center for nuclear research and development operated under contract with the U. S. Atomic Energy Commission by Associated Universities, Inc., sponsored by 9 leading eastern universities. The building was constructed by H. K. Ferguson Co.

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite Page 134 for securing additional information on items described in this department.

Steam Generators, Gas or Oil

Shown at the 10th International Heating and Ventilating Exposition in Philadelphia by Ames Iron Works, Oswego, N. Y., was its Amesteam generator available in a variety of sizes ranging from 10 to 500 hp in capacity and for pressures from 15 to 200 lb per sq in. These units are fully automatic and equipped for burning light oil, heavy oil, gas, or oil-gas combinations. A feature is the one-piece rear baffle which is removable, enabling cleaning of the combustion chamber.



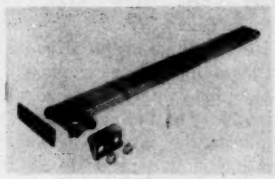
Boilers have a push-button station for starting and stopping; flame failure protector; refractory lined burner head; dampers for controlling secondary air; refractory type ignition ring; and a 3-pass gas flow as shown in the accompanying cutaway view. A low water cut-off is provided.

Gas vent is arranged for bolting to a breeching or stack but no large stack is required, nor are special foundations. The standard generator when shipped is ready for installation when connected to steam, water, fuel and electric lines, and chimney.

For more information, write on Inquiry Card, **Item 1**

Coils Fit in Side of Boiler

The Perma-head tankless hot water heating coil for side installation in steel boilers was displayed at the 10th International Heating and Ventilating Exposition in Philadelphia, by Lindy Heaters, Inc., New York, N. Y. It is designed to replace the smoke-box coil installation.



This tankless coil is installed through an opening in the front head of the steel boiler with the entire coil including heads, submerged below the boiler water-line inside the steam chamber with hot and cold water connections installed out the right or left side of the boiler through a welded steel terminal box. One or two coils may be installed through a single opening in the boiler.

Since the space in front of the boiler is clear for cleaning or replacing tubes, the coil can be removed at any time for examination. No part of the coil is in the smoke chamber, which is subjected to corrosion.

The coils are made in nine sizes rated at 40 degrees to 140 degrees with boiler water at 180 degrees with a pressure drop not exceeding 10 lbs per square inch. The coils are made of ⅝ or ¾ inch O.D. straight, seamless drawn, copper tubing.

For more information, write on Inquiry Card, **Item 2**

Packaged Hot Water Boiler

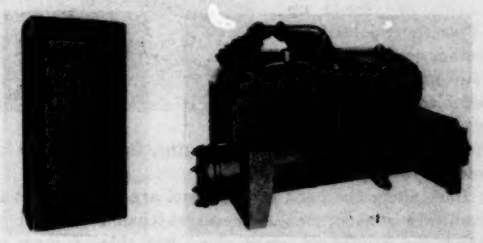
On display at the 10th International Heating and Ventilating Exposition in Philadelphia was the packaged oil-fired hot water boiler made by Waterfilm Boilers, Inc., Jersey City, N. J. This boiler, finished in gray hammertone, is shipped completely assembled and wired with combustion chamber, burner, circulator and controls in place ready to connect to the system.

The boiler is equipped with a tankless coil, pressure relief valve, ½ inch feed valve, ¾ inch circulator, Protectorelay, dual hot water control, operating hot water control, line voltage thermostat, expansion tank and combined altitude temperature gage.

For more information, write on Inquiry Card, **Item 3**

New Conditioners, Compressors

Three entirely new self-contained air conditioning units were shown for the first time in the exhibit of Curtis Refrigerating Machine Division, St. Louis, Mo., at the 10th International Heating and Ventilating Exposition. These units (left photo) complete the Curtis line from 2 to 15 tons, the line now consisting of 2, 3, 4 and 7½ ton capacity self-contained units, and 10 and 15 ton central type conditioners.



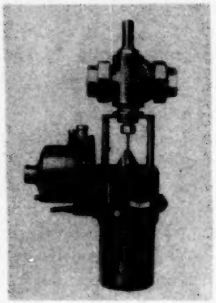
New 20 through 40 hp refrigeration compressors (right) were also on display. The compressors can be equipped with automatic capacity reduction and have full pressure lubrication on all bearings. They can be supplied as compressor units, or combined with a variety of cleanable shell and tube condensers to meet any conditions.

For more information, write on Inquiry Card, **Item 4**

Weather Compensating Control

A feature of the exhibit of Sarco Co., Inc., New York, N. Y., at the 10th International Heating and Ventilating Exposition was its new Type W Sarcostat. This is a weather compensating control for steam heating systems, especially those for multi-story buildings.

The double seated, closely balanced control valve is installed in the main steam line to each zone, and this valve is positioned by a liquid-filled thermostatic bulb which is located on the outside of the building and shielded from the sun's rays. Expansion of the filling in the bulb as the outside temperature increases determines the throttling position of the modulating valve. This valve position is also influenced by the steam or vapor pressure existing on the downstream side of the valve.



The mechanism at the left of the illustration modifies the valve movements by making it dependent not only on the outside temperature but also on the steam pressure in the system. Since the control is full floating, the valve may be made to assume any position between open and closed as required to secure a pressure in the system sufficient to furnish the proper amount of steam for any given condition of weather.

Valve is available in 11 sizes from ¾ to 8 inches.

For more information, write on Inquiry Card, **Item 5**

Cast Iron Baseboard Panels

The Snug cast iron baseboard panel for forced hot water or two-pipe steam was displayed by Weil-McLain Co., Michigan City, Ind., at the 10th International Heating and Ventilating Exposition in Philadelphia. The panels are made up of sections joined together with push nipples and can be assembled to form panels from three feet in length up to any desired lengths, in increments of one foot.

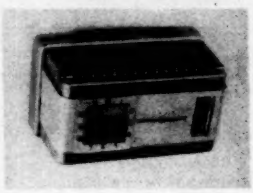
Cast along the back of the panel are vertical fins to facilitate convection. A metal extension is used to finish the baseboard panel along one side of room or it can be continued to form a baseboard similar in appearance to the cast iron baseboard radiation around the perimeter of the room.

The panels have a rating of 242.5 Btu per hour output per linear foot of panel with the water temperature averaging 150 degrees, or 540 Btu per hour per foot of panel with 215 degree water or steam.

For more information, write on Inquiry Card, **Item 6**

Low Voltage Clock Thermostat

The GE clock thermostat was shown by General Electric Co., Air Conditioning Department, Bloomfield, N. J., at the 10th International Heating and Ventilating Exposition. This clock is available for controlling the company's heating systems, or separately if desired. Day and night temperatures desired are set externally.



The switch is of the single pole, single throw type. A fall of temperature closes the circuit and a rise in temperature operates it. Thermostat has a range from 50 to 80 degrees with adjustable differential. It is of the low voltage type and is supplied with 115 to 25 volt transformer. It is finished in silver-bronze, the dimensions being 2⅞ inches high, 5 inches wide and 2½ inches deep.

For more information, write on Inquiry Card, **Item 7**

Spreader Flame Gas Burner

A spreader flame conversion gas burner was shown by Eckhart Mfg. Co., Inc., Union, N. J., at the 10th International Heating and Ventilating Exposition in Philadelphia. The burner is adaptable to warm air, steam, or hot water systems, and is approved by AGA.

Burner has a variable orifice which is set by installers, a machined primary air mixer and an accurate secondary air adjuster. It is available in three models as follows: A300-1, with an input of 65,000 to 200,000 Btu per hour; A300-2, 65,000 to 300,000 Btu per hour; and A300-3, 65,000 to 180,000 Btu per hour.

For more information, write on Inquiry Card, **Item 8**

Tool Serrates Graphite Pipe

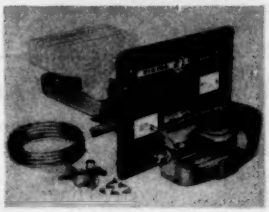
An improved hand serrating tool for use with Karbate impervious graphite pipe has been introduced by National Carbon Div., Union Carbide and Carbon Corp., New York, N. Y. Since Type FC flexible couplings are used in fitting impervious graphite pipe where strong, flexible joints are required, the effectiveness of the joint depends to a considerable extent upon the quality of the serrations on the pipe.

The tool is simple, rugged in design and extremely easy to use, assuring a tight, workmanlike joint in a minimum of time. It provides an advantage over other types of piping since it facilitates quick assembly of the pipe on the job site. Pipe sizes from 1 to 6 inches inclusive may be serrated.

For more information, write on Inquiry Card, **Item 9**

1 Humidifier Fits All Furnaces

The Model 2300 humidifier was the highlight of the exhibit at the 10th International Heating and Ventilating Exposition in Philadelphia by Viking Air Conditioning Corp., Cleveland, Ohio. This unit is a one-design model that does away with the long-familiar problem of dealers in stocking an extended range of sizes and types.



The 2300 is a complete line in just one model and size. It fits any type of furnace with round, sloping or straight plenums. It functions in either gravity or forced air operation of coal, gas or oil heat.

Twelve inches long, it fits into the most compact heating unit. Yet its evaporating capacity can be increased to humidify even the largest home adequately. At full capacity it affords 888 square inches of evaporating surface.

The new 2300 Humidifier has an average installation time of 20 minutes. Only a drill, tin snips and a screwdriver are needed to install it in any type furnace. The only direct attachment necessary is made with just six screws, inserted from outside the furnace. The humidifier itself slides in or out the plenum opening like a file drawer in its cabinet. All leveling and final adjustments can be made by hand-setting just three wingnuts.

The homeowner himself takes complete charge of cleaning and servicing his humidifier once it is installed.

For more information, write on Inquiry Card, **Item 10**

Baseboard for Forced Hot Water

Displayed at the 10th International Heating and Ventilating Exposition in Philadelphia by The National Radiator Co., Johnstown, Pa., was the National Art baseboard, installed at the junction of floor and wall and for use with forced hot water systems.

The heating element of the new baseboard unit is made of ¾ in. commercial copper tubing on which is bonded a series of helical copper fins. The steel enclosure is provided in the form of a back panel assembly and a front panel assembly. Heating elements, back and front panel assemblies in 8 ft lengths, are each packaged 6 pieces to a carton. This allows placing of the back panel and heating element along the wall surface without opening front panel cartons until needed for job completion.

Hot water ratings range from 370 Btu per hour per linear foot at a water temperature averaging 170 deg, up to 730 Btu per hour per linear foot with a water temperature averaging 230 deg. The unit is designed so that the front panel will not become too hot for children to touch.

When installed semi-recessed along the outer walls, baseboard extends only 1½ inches into the room. It is not recommended for gravity hot water systems.

For more information, write on Inquiry Card, **Item 11**

Cure for Porous Castings

Impregnating equipment for sealing pressure castings rejected because of porosity has been announced by Tincher Products Co., Sycamore, Ill. It is for small foundries and intended to solve "leaker" problems in small parts and castings.

The process is simple, effective and economical. The equipment requires no expensive plant alterations. No skill is required, and labor and material costs for impregnating parts of castings run as low as ¾ cents per pound.

A part or casting once sealed is pressure tight for the life of the part. An impregnated casting will withstand any pressure, temperature and chemical condition that the part was designed for.

For more information, write on Inquiry Card, **Item 12**

2 Lines of Cooling Towers

A line of evaporative condensers and cooling towers, known as types P and PT, has been announced by Baltimore Aircoil Co., Inc., Baltimore, Md., and was introduced at the 10th Annual International Heating and Ventilating Exposition at Philadelphia. These units are designed for outdoor installation only. The type P evaporative condensers (illustrated) are especially suited for dry operation during the winter.

Type P units have a capacity range of from 3 to 100 tons of refrigeration in the following sizes: 3, 5, 7½ and and 10 tons and from 10 to 100 tons in 5 ton increments. These ratings are based on 40 deg suction temperature, 105 deg condensing temperature and 78 deg wet bulb using Freon-12 refrigerant.

The type P line incorporates Mono-Drive for fan and pump as standard on all sizes. Drive guards and rain hoods are standard equipment. Vertical pumps drain automatically when sump is emptied. Motors are ball bearing with special type A tropical insulation suitable for outdoor installation. Propeller fans are of the wide blade, slow speed, quiet operating type.

The type PT cooling towers are similar in construction, and capacity ranges are the same as the type P units based on 3 gpm per ton of refrigeration with 95 deg water on the tower and 85 deg off at 78 deg wet bulb.

For more information, write on Inquiry Card, **Item 13**

Fan Window Units

The latest development in air conditioning equipment for multi-story multi-room building applications, such as office buildings, hotels, hospitals and apartment houses was displayed at the 10th International Heating and Ventilating Exposition in Philadelphia by York Corp., York, Pa. This consisted of a line of three fan window units which are said to meet the physical and space requirements and still retain the attractive features of central station type air conditioning systems plus several new important features.

These units, from 5,000 to 18,000 Btu per hr capacity, require a minimum of building space and are physically adaptable to existing buildings as well as to new construction. Only three pipe connections are required to install the units—chilled water supply and return, and drain piping. This design also minimizes the size of apparatus rooms, since space must be provided for only a central water cooling system.

The system permits varying the quantity of fresh, filtered air introduced into the conditioned spaces, from zero to 100%.

Each unit has a centrifugal fan direct connected to a 3-speed fan, a water cooler and large oversize filters. An outside air plenum located in the back of the unit may be connected to an outside air intake from a wall opening or fitted to a window with a special duct. The discharge air opening is sized to fit a standard grille. Casings are insulated to deaden sound and to eliminate any possibility of sweating.

The conditioners may be installed initially for heating and ventilating only, and complete air conditioning provided at a later date. To do this it would only be necessary to add a central chilled water system which can be done without disturbing any architectural or structural features of a building or inconveniencing the building occupants.

For more information, write on Inquiry Card, **Item 14**

Non-Brittle Pipe Compound

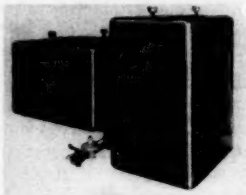
A leakproof joint compound applied in liquid form to flanged or threaded pipe connections, and which changes in the joint to a tough, elastic solid with great resistance to vibration and corrosion, has been introduced by West Chester Chemical Co., West Chester, Pa., under the name Cyl-Seal. The compound never becomes hard or brittle but does mold a tough resilient gasket into every joint.

The compound is not dissolved or otherwise affected by oil, gasoline, kerosene, natural gas, propane, butane, oxygen, steam, acids, alkalies and most other chemicals and solvents. It is low in cost and available in a number of convenient package sizes. Joints made up with the compound can always be taken apart without damage to threads or fittings regardless of type of service or age of joints.

For more information, write on Inquiry Card, **Item 15**

Large Capacity Gas Burner

Two new Janitrol gas conversion burners identified as Models SC-05, designed primarily for commercial and industrial installations for converting steam, hot water or warm air systems to natural or mixed gases, are introduced by Surface Combustion Corp., Toledo, Ohio. Both models are complete factory assembled packages to meet input capacities from 325,000 to 750,000 Btu per hour.

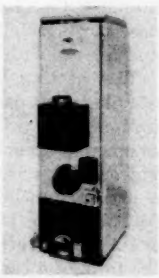


Simple installation and full accessibility are among the many features. Optional equipment to meet local requirements of gas utilities, city, underwriters and insurance companies, include instantaneous flame failure protection with complete control panel. Specifications and performance data are available from the manufacturer in Bulletin JS-162.

For more information, write on Inquiry Card, **Item 16**

Counterflow Gas Furnaces

The No. 70 and 90 series gas-fired counterflow warm air furnaces were displayed by Ko-Z-Aire, Inc., Red Oak, Iowa, at the 10th International Heating and Ventilating Exposition in Philadelphia. These units are designed especially for installation in houses constructed on a concrete slab or in basementless homes where warm air is discharged directly into ducts located either in or under the floor.



The reverse-flow principle discharges warm air through the opening in the base of the cabinet into (1) a warm air pit, when warm air pipes are imbedded in the concrete slab; or (2) a warm air plenum when warm air pipes are located under the floor. Special controls prevent overheating of the units in case of blower failure.

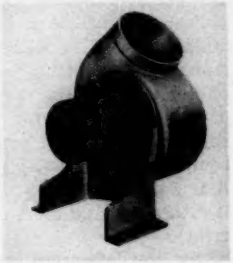
Units are shipped from factory completely assembled and wired.

Capacities are 56,000 Btu per hour output for the Model 70, and 72,000 Btu per hour output for the Model 90. Floor space occupied by the units is 21 x 21 inches; height is 70 inches.

For more information, write on Inquiry Card, **Item 17**

Junior Size Blower, 1 Size

The No. 53 Junior fan, intended for small industrial applications or small ventilating jobs, has been introduced by The New York Blower Co., Chicago, Ill., and was exhibited by that company at its exhibit at the 10th International Heating and Ventilating Exposition in Philadelphia. The blower has a capacity of 336 cfm free delivery or 180 cfm at ½ inch static pressure.

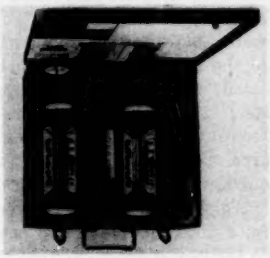


Fan is lightweight, weighing only 11 lb, and and has cast aluminum housing and slow speed wheel. Motor is the totally enclosed, fan-cooled, shaded pole type, 1500 rpm, 120 watts. It is furnished only in single phase.

For more information, write on Inquiry Card, **Item 18**

Combustion Testing Kit

The Fyrite Duplex Kit was recently introduced by Bacharach Industrial Instrument Co., Pittsburgh, Pa., and shown at the 10th International Heating and Ventilating Exposition in Philadelphia.



This kit, for combustion testing, consists of a carbon dioxide indicator (lower left of photograph), oxygen indicator (right), stack thermometer with range of 200 to 1000 degrees (upper center), neutral pressure point indicator (upper left), and a stack loss slide rule (shown in the lid of the kit). The neutral pressure point indicator is intended particularly for setting gas conversion burners.

The kit is also available with a standard draft gage in place of the neutral pressure point indicator. Draft gage is available in two ranges, 0.14 inches updraft to 0.10 inches down-draft and 0.25 inches updraft to 0.05 inches down-draft.

For more information, write on Inquiry Card, **Item 19**

Glass Conducts Electricity

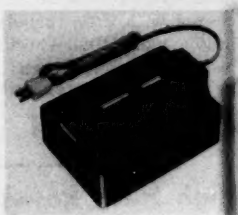
Electropane glass has been developed by the Libby-Owens-Ford Glass Co., Toledo, Ohio, to conduct electricity so that among its many applications can be included resistance heating.

In its manufacture, a thin, transparent, metallic oxide film can be applied to either or both surfaces of a pane of glass. Usually, it is put to work in the form of a lamination, with the metallized side of the glass inside the glass-plastic sandwich. Built-in thermostats control the heat when used for resistance heating. Electrical energy is applied to the film by means of bus bars on the surface of the glass along opposite edges. These bars are about ¼ inch wide and 0.003 inch thick and have a resistance of about 0.1 ohm per linear foot. Either a-c or d-c current can be used. A piece of Electropane 24 x 12 inches with the bus bars along the long sides of the glass has a resistance of 50 ohms. While the glass will withstand temperatures up to 482F, a maximum of 150F is recommended as a limiting temperature for plastic laminations.

For more information, write on Inquiry Card, **Item 20**

Glycol Appliances Cut Colds

Two models of Glycolators, automatic machines for saturating air with germ-killing triethylene glycol, were shown at the 10th International Heating and Ventilating Exposition in Philadelphia. One model, the Rex (top view) is for homes, the other, the Regal (bottom view) is for commercial or industrial use. They are products of Iron City Chemical Co., Glycolator Div., Valencia, Pa.



The Rex, which will retail at $9.95, including a month's supply of Glycosol, is furnished in an attractive mahogany plastic case suitable to tabletop display in any room in the house. It is approximately as large as a cigarette chest, weighs about a pound, operates on A.C. or D.C. current, consumes about 25 watts of current, and has a permanent type heating element. It holds a pint of Glycosol and will treat 7,500 cu ft of air (equal to an average six-room house) for about 300 hours continuously on one filling.

The Regal model is a portable unit measuring less than a foot square. It will treat up to 100,000 cu ft continuously, so that one or more units, properly located, will serve for offices, schools, restaurants, theaters, factories, work shops, and numerous other applications. Vaporization is thermostatically controlled and the vapor is circulated by a high speed enclosed fan.

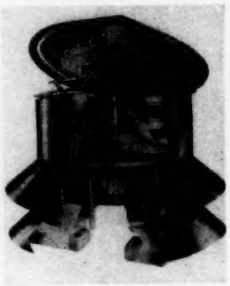
Actual tests have shown a reduction in colds and respiratory ailments of about 50% when using Triethylene glycol. In hospital ward tests persons occupying beds adjacent to measles cases were not infected when dust control and glycol vapors were used in combination.

Consequently, a main selling point of such devices is their possible importance in eliminating a large percentage of absenteeism.

For more information, write on Inquiry Card, **Item 21**

Quiet Exhauster for Roofs

The Gyra-Flo roof exhauster was displayed by Chicago Blower Corp., Chicago, Ill., at its exhibit at the 10th International Heating and Ventilating Exposition. This exhauster was designed for quiet and efficient ventilation in schools, churches, hospitals, theaters and similar applications where roof ventilation is applicable.



Unit operates at a low noise level, and is low, streamlined and weatherproof. Motor is isolated from exhausting air, while hinged cover permits easy maintenance. Discharge cones have 360 degree discharge with little turbulence. Construction is welded heavy steel plate. Wheel is backward curve, non-overloading dynamically and statically balanced. Air deliveries from 680 to 53,800 cfm. Static pressures from ⅛ to ¾ inches.

For more information, write on Inquiry Card, **Item 22**

High Heat Resistant Paint

An extra high heat-resistant aluminum paint, capable of withstanding temperatures up to 1,700 deg, is announced by Speco, Inc., Cleveland, Ohio. Known as Heat-Rem H-170, the new paint utilizes a silicone base and fuses with surface metal immediately upon application. It is reputed to form a bright, elastic finish resistant to moisture, corrosion, mild acids, alkalis and industrial fumes.

The paint is said to set in 4 hours and dry completely overnight on hot surfaces. It is recommended for use on heat lines, condensers, compressors, ovens, engine heads, radiators, exhaust manifolds, etc. The manufacturer states that it makes possible the effective painting of many types of industrial equipment which have previously been regarded as unpaintable due to temperature limitations. It is intended for use as a companion product to standard Heat-Rem which is adapted to applications in the temperature range of 1,000 to 1,500 deg.

For more information, write on Inquiry Card, **Item 23**

3 Models of Gas Conversions

An automatic gas conversion burner has been introduced by Quiet-Heet Mfg. Corp., Newark, N. J., and was exhibited at the 10th International Heating and Ventilating Exposition at Philadelphia. It is available in three models, two of which are for natural gas with maximum inputs of 120,000 and 220,000 Btu per hour capacity. The third is for mixed or manufactured gas and has a maximum input of 165,000 Btu per hour.

Features include a flame director of heavy gage stainless steel to withstand high temperatures. A flame stabilizer ring for economy is provided. The burner support is adjustable for accurate positioning of the burner and the mixer tube is telescopic for adjustment to the center of the furnace. Unit is equipped with a safety pilot and pilot lighter so that it is not necessary to open the furnace door to light it. An automatic room thermostat is standard equipment.

For more information, write on Inquiry Card, **Item 24**

Junior Feedwater Heater

A feedwater heater, designed specifically for small manufacturing plants, institutions, public buildings, dairies, laundries and greenhouses, with boiler capacities of 300 hp or less is announced by The Swartwout Company, Cleveland, Ohio.

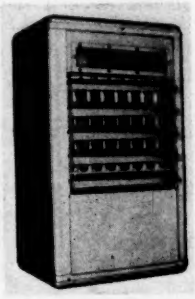
Known as the Junior feedwater heater, the unit utilizes exhaust steam to heat the water before it is delivered to the boiler. Made of fabricated steel, it has stainless steel trays which disperse feedwater in the form of thin curtains over a large area, so that the exhaust steam gives up its heat quickly and evenly.

Ample water storage space eliminates the necessity for a sump or hot well. Condensate returns are piped to the heater for quick reheating to near boiling point.

For more information, write on Inquiry Card, **Item 25**

Gas-Fired Unit Heater

The Luxaire gas-fired unit heater has been introduced by The C. A. Olsen Mfg. Co., Elyria, Ohio, and was displayed by that company at the 10th International Heating and Ventilating Exposition at Philadelphia. The unit has an AGA approved rating of 100,000 Btu per hour input.

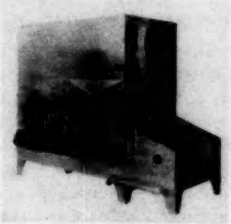


The cabinet, smartly designed, is baked enamel, with adjustable louvers. Heating surface is of steel, welded. The gas burner is multi-port with provisions for easy removal or inspection.

For more information, write on Inquiry Card, **Item 26**

Blower Type Cooling Towers

Addition of a complete line of centrifugal fan induced draft cooling towers to its present line of propeller fan towers is announced by E. D. Goodfellow Co., Inc., Memphis, Tenn., and was displayed at the 10th International Heating and Ventilating Exposition in Philadelphia. The new towers are available in the following sizes: 2, 3, 5, 7½, 10, 15, 20, 25 30, 40 and 50 ton capacities.



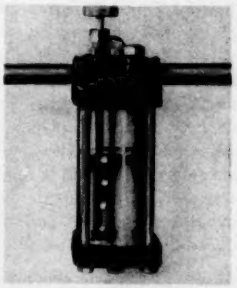
Some of the features of the line are quiet ample capacity fans, counterflow of water and air, W-shaped eliminators, staggered cypress decking so designed as to hold the water in the air stream the required length of time for maximum efficiency, one-piece non-clogging bronze spray nozzles, compactness, ready accessibility to all parts through use of access doors and easily removable panels, rugged construction, and corrosion-resistant covering inside and out.

Towers may be had as complete units, including pump, drives and motors, or less pump for remote installations.

For more information, write on Inquiry Card, **Item 27**

Bubbler, Trap for Pipe Lines

Two new units for use in gas and air lines are announced by King Engineering Corp., Ann Arbor, Mich. One is a sight-feed bubbler to control and visually indicate relatively small rates of flow; the other is a sediment trap for removing dirt and moisture from the line.



With the bubbler (illustrated), the entire flow of gas or air is passed through liquid in a transparent cylinder, where the rate of flow is shown by the bubbles rising through the liquid. Any desired liquid may be used. A needle valve at the top permits selection of any rate of flow from less than 1 bubble per second to approximately 20 cu ft per hour. Typical applications include bleeding air into lines to purge them of corrosive fumes, and use with hydrostatic liquid-level gages to control and show the flow of compressed air required for continuous gaging.

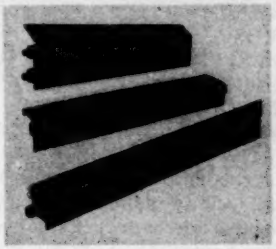
The sediment trap is identical to the bubbler except that it does not have a needle valve, dip tube or filler plug. This unit handles a maximum flow of approximately 6 cfm at 25 lb per sq in. differential pressure.

Both units have a drain plug at the bottom which permits easy removal of excess liquid built up by condensation of moisture in the gas or air. The cylinder is glass or plastic, depending on pressure requirements.

For more information, write on Inquiry Card, **Item 28**

Finned Heaters, 3 Types

A line of Fin-Vector radiation is announced by C. A. Dunham Co., Chicago, Ill., and was shown at that company's exhibit at the 10th International Heating and Ventilating Exposition in Philadelphia. The line includes sloping top units (top view), flat top units, (bottom view), and expanded metal cover units (middle view), which may be ordered to accommodate one, two, or three-tier heating element assembly.



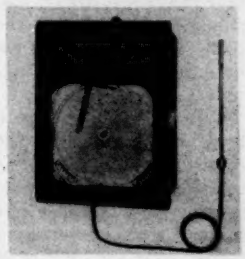
The fins are of 22 U. S. gage steel or No. 16 Brown and Sharpe gage aluminum, spaced 24, 32 or 48 per linear foot depending on the heating capacity required. Tubes are of seamless steel or Type K copper.

An unusual adjustable hanger assembly for use with the sloping top cover permits the element or elements to expand or contract freely without damage to walls or to heating elements.

For more information, write on Inquiry Card, **Item 29**

Temperature Recorder-Controller

Development of a new and improved proportional action recorder-controller, useful in many of the processing industries and in all applications where a record of the controlled temperature is desired, is announced by Johnson Service Co., Milwaukee, Wis. The instrument was shown at the 10th International Heating and Ventilating Exposition in Philadelphia.



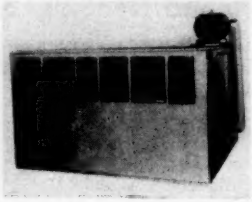
Called the Record-O-Stat, the unit is designed to control either air or liquid temperatures. It may be operated as either a direct or reverse acting controller to suit the requirements of the application. Sensitivity of control action is readily adjustable by varying the throttling range, which is adjustable up to 100% of the chart range.

For exacting applications, where a simple proportional action controller cannot produce the desired degree of control, the device is available with an automatic reset feature which coordinates the deviation in control with the various thermal lags inherent to the system being controlled.

For more information, write on Inquiry Card, **Item 30**

Multi-Zone Conditioning Units

On display at the company's exhibit at the 10th International Heating and Ventilating Exposition in Philadelphia was the Type CMZ multi-zone air conditioning units made by Marlo Coil Co., St. Louis, Mo. These units are designed for application where one unit must serve one or more zones. Eight sizes are available with coil face areas ranging from 4.5 to 28 square feet. The total air volume ranging from 1,500 to 17,000 cfm can be divided for two to six zones.



The units ventilate, filter, heat, humidify, cool and dehumidify and it is possible to heat in one zone while cooling in another. Each zone has its own dampers for modulation of air flow.

Full information, construction details, capacities, and other features are available in Bulletin 409MZ.

For more information, write on Inquiry Card, **Item 31**

Shaft Seals for Pumps

To meet the shaft sealing needs of pump manufacturers, Sealol Corp., Providence, R. I., offers a new line of mechanical seals: the FCB and GCB Sealol balanced pressure seals. These are all-in-one seals, complete in one package.

Construction of the seals eliminates possibility of lost parts, damaged parts, faulty assembly, or contamination of the lapped seal faces. No special machining on the part of the pump manufacturer is required when the seals are used.

Rubber friction members, incorporated in the rotating and stationary elements of the seals, provide the proper driving and holding actions. This design permits hand assembly of the seal in the pump. Press fits and special inserting tools are not required.

The seals are built of corrosion-resistant materials and can be furnished to handle water, oil, kerosene, or gasoline. They are available for shaft sizes from ⅜ to 1½ inches.

For more information, write on Inquiry Card, **Item 32**

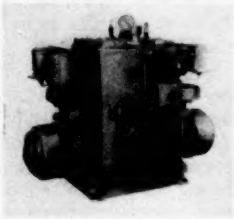
Small Flame Failure Control

Firetron, a flame scanner, was introduced at the 10th International Heating and Ventilating Exposition in Philadelphia by the maker, Combustion Control Corp., Cambridge, Mass. Smaller than any scanner previously offered, the new device is sensitive to all types of gas and oil flames, yet discriminates between flame and hot refractory. Simple, it overcomes a multitude of problems which previously have made the installation of flame failure equipment complex and expensive.

For more information, write on Inquiry Card, **Item 33**

Vacuum Heating Return Pump

Displayed for the first time at the 10th International Heating and Ventilating Exposition was the Type VE vacuum heating return pump made by American Hydrovac, Brooklyn, N. Y.



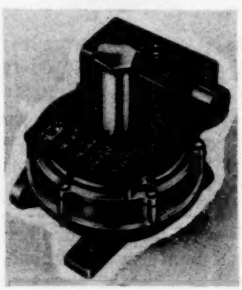
This pump is now being made in capacities ranging from 2,500 square feet of equivalent direct radiation to 65,000 square feet at pressures from 20 to 40 lb per square inch. It is basically similar to the company's Type V pump, the difference being, however, that an axial-air gap motor is substituted for a motor of conventional design and the motor-pump unit is cantilevered from the receiver instead of being supported by the base.

A mechanical seal is standard equipment on the Type VE, thus stuffing box troubles are reduced and connections to a drain eliminated.

For more information, write on Inquiry Card, **Item 34**

DeLuxe Gas Conversion Burner

The new Janitrol DeLuxe gas conversion burner (top view) introduced by Surface Combustion Corp., Toledo, Ohio, features the Uni-Thrift combination gas valve and pressure regulator with only five moving parts (bottom view). The new model is exceptionally quiet, provides better pressure regulation and is more compact. Because of its greater simplicity and reduction of many complicated parts used in separate gas valves and pressure regulators, service is minimized and a long life is assured.

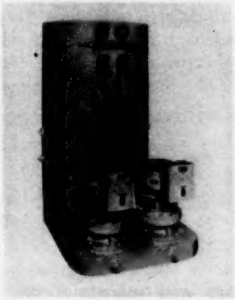


Other features include the Turbo-Flame diffuser to accelerate combustion and hasten heat response, automatic pilot, time-modulated thermostat, the Electro-Fyre igniter, and exceptionally fine appearance. Complete information is available in Bulletin JS-144.

For more information, write on Inquiry Card, **Item 35**

Hospital Vacuum-Pressure Unit

The Whittington clinical combination vacuum and pressure systems, Model PHT, has been introduced by Whittington Pump & Engineering Corp., Indianapolis, Ind., and was shown at the 10th International Heating and Ventilating Exposition, Philadelphia. By providing a dependable supply of vacuum or pressure automatically at convenient connections, these central systems offer the hospital an opportunity to increase efficiency and lower costs.



These systems conserve space, simplify arrangement and eliminate noise by replacing individual vacuum and pressure units in operating rooms, bedrooms and laboratories. Either system is less expensive to operate than the number of individual units required to handle the same volume of vacuum or pressure.

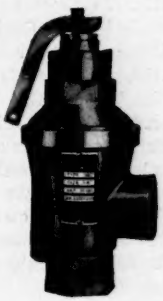
Each system is built in various sizes. They are completely packaged and require only a small amount of floor space. They may be located in any out-of-the-way place, above, below or on the same level as the connections they serve.

Both the pressure system and the vacuum system employ a water jet pump.

For more information, circle on Inquiry Card, **Item 36**

Steam Safety Relief Valve

The Cadwell No. 300 safety relief valve was shown for the first time at the 10th International Heating and Ventilating Exposition by The Beaton & Cadwell Mfg. Co., New Britain, Conn. This valve, designed for low pressure heating boilers, is a diaphragm-control, full-opening orifice valve with a steam capacity of 350,000 Btu per hour at 30 lb pressure. This is said to be sufficient to take care of 90% of heating boiler installations.



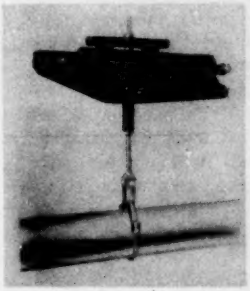
This valve has been designed for the special purpose of taking care of all possible dangerous overpressures which may occur in the heating system in a runaway boiler, one in which all other controls failed. It is also intended for other vessels requiring a large capacity relief.

The valve will relieve at low pressures created by the expansion of the water in heat as well as pure steam and will discharge water of any temperature corresponding with the pressure setting of the valve.

For more information, circle on Inquiry Card, **Item 37**

High Pressure Pipe Support

The Model L constant support for piping was shown by Grinnell Co., Inc., Providence, R. I., at its exhibit at the 10th International Heating and Ventilating Exposition in Philadelphia.



This support, designed for high temperature, high pressure piping, gives a constant support to pipe subject to verical movement in all positions of travel. It is non-resonant and is individually calibrated for each installation.

Sixteen spring sizes are available to meet the range of loads from 141 lb to 19,530 lb with three different structures to accommodate total travel requirements of 2½ inches, 5 inches and 10 inches, maximum.

Field load adjustment can be accomplished by turning a single bolt. The total travel of 13 sizes may be changed in the field. The hanger is nearly symmetrical and the load coupling is suspended from the center of the hanger.

For more information, circle on Inquiry Card, **Item 38**

Packaged Air Conditioner

Addition of an 11-ton packaged air conditioner to the present line of 2-, 3-, 5-, and 8-ton packaged units has been announced by Airtemp Division, Chrysler Corp., Dayton, Ohio.

Equipped with a sealed radial compressor, which operates at 3,500 rpm, this unit has a cooling capacity of 132,000 Btu per hour. The compressor, directly connected to the motor, is cushion-mounted and sealed in a bath of oil.

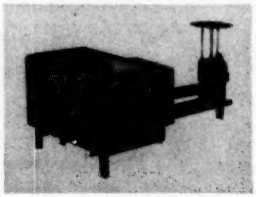
Return air grille is equipped with cleanable type filters. A Maxi-fin cooling coil is employed, and the combination condenser and receiver is equipped with coil-type spiral finned water passages.

Two dynamically balanced fans are used, both suspended, in self-aligning cushioned bearings and driven by a heavy-duty, rubber-mounted fan motor. Other features include an automatic water regulating valve, built-in thermostat and limit control, super-finished moving parts and factory installed internal wiring. Cabinet is 16-gage steel, bonderized to resist rust and finished in baked spatter enamel. A heating coil is available as optional equipment for year-round service. Unit occupies only 11.25 square feet of floor space when installed.

For more information, circle on Inquiry Card, **Item 39**

Fully Automatic Gas Burner

Among the equipment shown by International Heater Co., Utica, N. Y., at its exhibit at the 10th International Heating and Ventilating Exposition, Philadelphia, was its new Economy gas conversion burner, fully automatic, and AGA approved. The burner is factory assembled, requires a minimum of adjustments in the field, and will operate with good results in either warm air furnaces or steam and hot water boilers. No brick or metal combustion chamber is required.



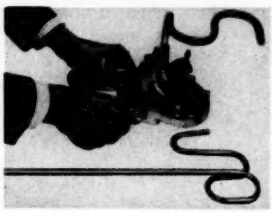
Used with natural, mixed or manufactured gases, the unit is made in one model with outputs from 36,000 to 108,000 Btu per hour.

Features include a durable chrome alloy steel flame spreader; heavy cast-iron burner; single unit igniter tube; pilot gas and vent tubes readily removable for service through the air duct without disturbing main gas piping, electrical wiring or the burner; pilot igniter, and adjustable legs.

For more information, circle on Inquiry Card, **Item 40**

¼ to ½ Inch Tube Bender

On display at the 10th International Heating and Ventilating Exposition in Philadelphia by Tal Bender, Inc., Milwaukee, Wis., was the No. 1200 3-in-1 tube bender.



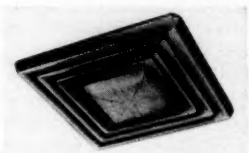
The bender is a lightweight, simple, and fast operating hand tool with no loose parts. The machine bends ¼, ⅜, and ½ inch Types K and L copper, aluminum and lightweight tubing up to 180 degrees.

The bender is said to be ideal for bending refrigeration coils, radiant heat coils, and other tube work.

For more information, circle on Inquiry Card, **Item 41**

Air Outlets, Lights, Combined

Shown for the first time at the 10th International Heating and Ventilating Exposition in Philadelphia was the Agitair Diffuser-lite fixtures which combine correct air distribution with high quality illumination, and which are made by Air Devices Inc., New York, N. Y.



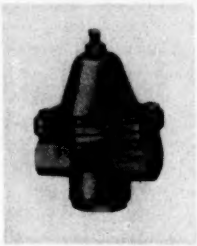
The new fixtures are artistically designed in square and rectangular patterns and incorporate patented diffusing vanes for the correct air distribution.

The fixtures use incandescent or fluorescent lighting with flush, semi-flush, or louvered lenses. Hinged frames add to their simplicity of relamping and maintenance. They are constructed of light gage steel, finished in baked aluminum lacquer, or prime coat for painting. The steel recessed boxes are lined with asbestos heat insulation and equipped with reflectors.

For more information, circle on Inquiry Card, **Item 42**

Pressure Reducing Valve

The Type E-41 pressure reducing valve has been introduced by A. W. Cash Valve Manufacturing Corp., Decatur, Ill. It is similar to the company's Type E valve but without an inbuilt strainer, and is intended for use in large residential buildings and industrial installations for water and air.



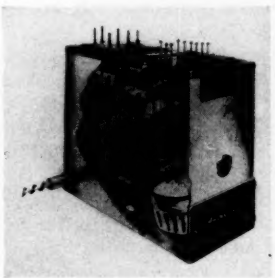
Valve is of the yoke type with Hycar seat discs which resist sticking, and a Neoprene diaphragm. It is built for initial pressures up to 250 lb, but delivery pressures from 30 to 150 lb are available. Standard factory setting is 45 lb unless specified otherwise.

The valve is made in three sizes for 1¼, 1½ and 2 inch pipe.

For more information, circle on Inquiry Card, **Item 43**

Heaters Burn Low Cost Coal

On display at the 10th International Heating and Ventilating Exposition in Philadelphia was the line of completely automatic Anthra-Flo units, hot water, steam and warm air heaters which burn low cost buckwheat or rice anthracite. In these units, made by The Coal-O-Matic Co., Trucksville, Pa., coal feeds direct from the bin across the top of a slotted grate. As coal is burned it is pushed across the grate by the incoming coal, which in turn pushes the ashes off into the ash bin.



The accompanying cutaway view shows the Model WF-1 warm air furnace designed for the small home and with a capacity of 95,000 Btu per hour at the bonnet. It is also available in a larger model, WF-2, with a capacity of 130,000 Btu per hour at the bonnet.

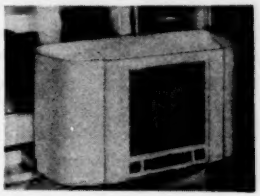
Model C1-A for steam or hot water has a capacity of 515 sq ft of hot water radiation or 325 sq ft of steam, while Model C2-A has a capacity of 880 sq ft and 550 sq ft for water and steam, respectively.

For more information, circle on Inquiry Card, **Item 44**

Cooler Does Not Block Window

On display at the 10th International Heating and Ventilating Exposition, Philadelphia, was the line of room air conditioners made by Mitchell Manufacturing Co., Chicago, Ill.

The line includes Model M-131 (illustrated), 1/3 hp capacity, which allows quick installation and easy window washing, since there is no opaque window filler panels to block out light or anchor the window closed. It can be installed in a conventional double hung sash window as narrow as 22 inches. Window sash slides down between decorative cabinet and outside cabinet to rest on rubber insulating cushion.



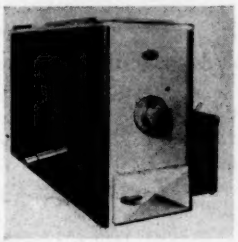
Over-all dimensions are 13⅛ inches high, 22½ inches wide and 30¾ inches deep. Capacity is 4200 Btu per hour and the unit cools, dehumidifies, filters, circulates and ventilates. Compressor unit, hermetically sealed, uses Freon-12 refrigerant.

Also available are Models M121, ½ hp, 6150 Btu per hour; M341, ¾ hp, 9050 Btu per hour; and M1001, 1 hp, 11,500 Btu per hour. These models include all parts necessary to install unit in conventional double hung sash windows up to 48 inches wide.

For more information, circle on Inquiry Card, **Item 45**

Stoker-Warm Air Unit

A new self-cleaning furnace-stoker unit has been introduced by Electric Furnace-Man, Inc., Emmaus, Pa., and was shown at the 10th International Heating and Ventilating Exposition in Philadelphia. It is available in two models, one with a capacity of 100,000 Btu per hour, the other 125,000 Btu per hour.



Unit consists of a steel furnace whose heating surfaces are in a vertical position, which aids in keeping surfaces clean. Fly ash is trapped out in a special compartment. The stoker mechanism has a ⅛ hp flanged motor with built-in overload protection, ratchet drive, and automatic stainless steel bin feed.

Unit is designed to burn rice or buckwheat size anthracite.

For more information, circle on Inquiry Card, **Item 46**

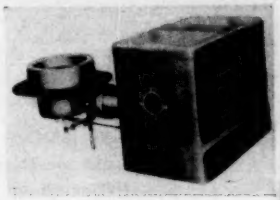
Float Valve Further Improved

A new regulator, made of Uscolite, a synthetic rubber product of the U. S. Rubber Co., is now being built into the M-VB No. 16 float valve by Scovill Mfg. Co., Waterville Div., Waterville, Conn. According to the manufacturer, the Uscolite regulator will not corrode under any conditions, and will not warp, shatter, expand, nor shrink. Originally announced early in 1950, the valve is quiet, fast-filling, and fully adjustable.

For more information, circle on Inquiry Card, **Item 47**

Oil Burner Has Flat Flame

An improved model of the Iron Fireman Vortex residential oil burner is now on the market, according to Iron Fireman Mfg. Corp., Cleveland, Ohio. This burner produces a whirling vortex of air which mixes with the oil spray to form a flat, bowl-shaped radiant flame. It releases its heat above the grate line where it blankets the hearth and side walls of the combustion chamber for increased efficiency.



Moving parts and adjustments are located in cool air, rather than below the combustion chamber, thus protecting these elements from heat and making it possible to service and adjust the burner easily.

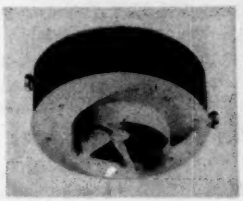
The burner is constructed of heavy pressed steel, sturdily welded and built for long service. Burner housings are accurately machined and the mounting chassis is of steel. This latter feature allows the burner to be installed without cement work or shimming. Each of the three legs on the chassis may be adjusted independently.

Capacity of the burner ranges from 1 to 2½ gallons of fuel oil per hour.

For more information, circle on Inquiry Card, **Item 48**

Vertical Discharge Unit Heater

A circular vertical discharge unit heater for use with either steam or hot water heating systems has been announced by C. A. Dunham Company, Chicago, Ill., and was displayed at the 10th International Heating and Ventilating Exposition in Philadelphia. A feature of the unit is a sturdy motor support cone which directs air from the heating element to the fan and protects the motor from excessive heat, dust and other impurities. The motor is mounted on rubber to minimize vibration and noise.



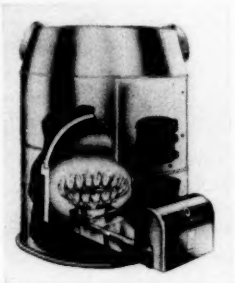
Supply and return pipes are connected to sides of the heater, making possible a simplified horizontal hook-up.

The units are made in seven sizes with capacities from 24,000 to 410,800 Btu per hour.

For more information, circle on Inquiry Card, **Item 49**

Telescope Duct for Gas Burner

Shown at the 10th International Heating and Ventilating Exposition in Philadelphia was the new Columbia Model J gas conversion burner made by The Columbia Burner Co., Toledo, Ohio.



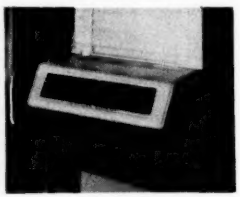
This burner is made in one size with a capacity of 75,000 to 200,000 Btu per hour. Features include a single port telescoping duct and venturi and an enclosure for the controls as well as for the piping on the outside of the heater.

For more information, circle on Inquiry Card, **Item 50**

½ and ¾ Ton Room Coolers

Two new room air conditioner models for home or office have been developed by Airtemp Div., Chrysler Corp., Dayton, Ohio.

Model 1650 (illustrated) is equipped with a 1 hp hermetically sealed compressor and Model 1675 has a ¾ hp compressor. Both do a complete air conditioning job, including cooling, dehumidifying, filtering, ventilating and circulating air in room. Both models are easy to install in practically any type of window. No plumbing connections are required. They can be plugged into any convenient 110-volt electrical outlet.



Small in size, measuring 15⅜ inches in height and 27½ inches in width, the 1 hp model is rated at 10,000 Btu per hour. The ¾ hp model has a capacity of 8,200 Btu per hour.

A turn of the plastic vanes adjusts the air grille to direct air circulation in any direction. The outside air intake may be opened as desired to provide ventilation the year-round. Outside air can be drawn into the room independent of the cooling mechanism if desired.

For more information, circle on Inquiry Card, **Item 51**

Enclosed Squirrel Cage Motors

The line of type QZE, totally enclosed, non-ventilated, squirrel cage, induction motors has been extended by the maker, Fairbanks, Morse & Co., Chicago, Ill., to include continuous duty ratings built in NEMA standard frame 284. At present, 7½ hp, 1800 rpm and 5 hp, 1200 rpm motors are in production.

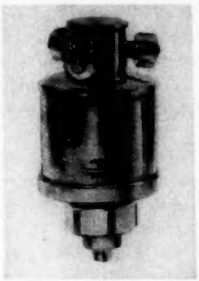
These motors conform in all respects to NEMA and ASA standards for totally enclosed machines, and are identical in mounting dimensions with standard totally enclosed, fan-cooled motors of the same ratings. They are suited for service in adverse locations where dirt, dust, lint, metal turnings and sand are prevalent, since there are no ventilating openings to clog.

Rotors are of the indestructible Copperspun construction. Ball bearings are of the cartridge type with ample grease space to permit sealing for the life of the bearing if desired, but with provisions for easy flushing and regreasing.

For more information, circle on Inquiry Card, **Item 52**

Vapor Heating Specialty

The Steamheat Master compensator was among the products shown by Radiator Valve Company of America, Philadelphia, Pa., at the 10th International Heating and Ventilating Exposition in that city. This valve, when used in conjunction with the company's induced vacuum radiator valves and end line evacuators, produces a moving column of air mixed with hot vapor from the boiler which continuously flows toward the radiators. The result is said to be a uniform distribution of heat throughout the entire system and the extraction of all available heat from the boiler.



On mild days the compensator heats radiators only as warm as necessary to satisfy the thermostat. In cold weather, when there is a heavy demand for heat, the radiators are at full steam temperature. In other words, this device creates a vapor system effective on either one-pipe or two-pipe jobs.

For more information, circle on Inquiry Card, **Item 53**

Wet Base All-Fuel Boiler

The Crane 14 boiler for oil, gas, coal or coke has been introduced by Crane Co., Chicago, Ill., and was exhibited at that company's booth at the 10th International Heating and Ventilating Exposition in Philadelphia.

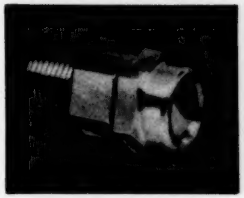
The boiler is of the wet base type and intended for home installations. It is reported to be easily converted from one fuel to another. It is made in four sizes, for hand-fired, oil-fired, or stoker-fired installations and with capacities ranging from 170 to 495 square feet of steam radiation, or equivalent in water.

Features include an extended jacket to conceal the burner, trombone heater opening on both sides, precision ground joints between sections, a glass flame observation port, and flange mounted oil burner (where intended for oil).

For more information, circle on Inquiry Card, **Item 54**

Line of Flat Spray Nozzles

A new and improved line of flat spray or fan nozzles, Series F, has been announced by Bete Fog Nozzle, Inc., Greenfield, Massachusetts.



Uniform coverage with little waste of spray is claimed. Side jets, or horns, containing coarse droplets have been eliminated and the spray pattern made heavier in the center than at the edges of the fan.

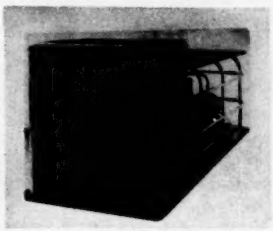
According to the maker, there is less overspraying due to doubling up of the sprays from adjacent nozzles with the result that the combined coverage is unusually uniform.

These nozzles include 13 discs made of long-wearing stainless steel with flow rates of 1/10 to 10 gpm and spray angles of 50 deg to 90 deg. All discs are interchangeable in a brass base-and-cap assembly having a ¼ inch male pipe connection. Built-in, removable strainers are available for the smaller nozzles.

For more information, circle on Inquiry Card, **Item 55**

—120 Deg. Chilling Machine

The Model R-120 Cascade Sub-Zero industrial chilling machine, with a guaranteed minimum temperature of 120 deg. below zero and a heat absorption capacity of 2,000 Btu per hour, has been introduced by Sub-Zero Products Div., Deepfreeze Distributing Corp., Cincinnati, Ohio.



The capacity given is for all temperatures from zero to —120 deg. when the work is immersed in a convection fluid in the chilling chamber. It is intended for industrial refrigeration applications, such as the treating of tool steel, seasoning of annealing gages, metal shrinkage for expansion fits, storage of annealed aluminum, testing of materials, and similar applications.

Chilling chamber, shown at the left, is 18 x 30 x 33 inches and with an interior wall of ¼ inch steel. It has a capacity of 10 cubic feet or 75 gallons. The machine includes power unit and chilling chamber, but former is available separately.

Outside dimensions are 42 inches high, 90 inches long and 39 inches wide over-all, including chilling chamber. Unit has two motors ¾ and 1 hp units, 3-phase.

Model R-120 is only one of a line of sub-zero chilling units made by the company, the full line being described in a newly issued catalog.

For more information, circle on Inquiry Card, **Item 56**

Neutral Pressure Indicator

Recently introduced and on display at the 10th International Heating and Ventilating Exposition in Philadelphia was the Neutral Pressure Point Indicator made by Bacharach Industrial Instrument Co., Pittsburgh, Pa. This is an especially sensitive draft gage designed specifically for testing gas burners and intended for use by gas equipment dealers, contractors and inspectors. It is capable of detecting even the slightest draft or pressure inside the furnace or over the burner and it is also valuable in checking the draft at the relief opening of the draft hood.

A determination of the neutral pressure point at the correct height in the furnace is required, particularly in setting gas conversion burners. For this test, the firing door is opened slightly and the slotted end of the draft tube projecting from the back of the unit is pressed against this crack, as shown in the illustration. Moving the device up and down will establish the exact location of the neutral pressure point which is indicated by zero gage reading.

The gage has a magnification of over 100 times, a pressure or draft of 0.001 inches of water being represented by a pointer movement of 3/32 inch. The range of the instrument is .0005 inches pressure to 0.005 inches draft.

For more information, circle on Inquiry Card, **Item 57**

Plug-In Humidity Controller

A plug-in humidity controller is announced by Abbeon Supply Co., Woodside, N. Y. This device fills the need for a simple automatic control to operate electrically powered humidifiers and dehumidifiers. No skilled electrician is needed to install the control.

To place in operation it is necessary only to plug the humidifier or dehumidifier into the control; plug the control into a wall outlet, and set the dial at the percent relative humidity desired.

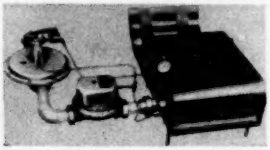
The controller can handle a load of 15 amp at 115 v, or a continuous load of 1,700 watts.

The humidistat utilized is a standard human hair type of dependable manufacture. Humidity scale is graduated from 20% to 100% relative humidity. Case is dark green baked crackled finish. Dimensions are 7¼ in. wide, 3¾ in. depth, and 6¾ in. height. Weight is 3¼ lb, and price is $45.

For more information, circle on Inquiry Card, **Item 58**

Blower Type Gas Unit Heater

A gas-fired blower type unit heater was displayed by Surface Combustion Corp., Toledo, Ohio, at the 10th International Heating and Ventilating Exposition in Philadelphia. This unit, AGA approved and designated as Model BCC-05, is intended for applications where it is necessary to deliver air at higher velocities than possible with propeller type fans and to deliver heated air through ducts. Typical installations are in industrial buildings and commercial establishments.

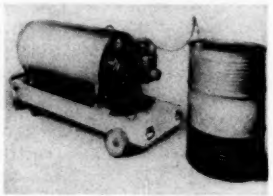


Units are available in six sizes, with capacities ranging from 68,000 to 373,500 Btu per hour output, vented, and for all gases, including liquefied petroleum.

For more information, circle on Inquiry Card, **Item 59**

Portable Warm Air Furnace

A fully portable warm air furnace is announced by Quiet Automatic Oil Burner Corp., Newark 4, N. J. It is equipped with the latest design Quiet Automatic oil burner. Design includes a new fuel saving Catomic adjustable turbulator in the burner nozzle.



The furnace can be wheeled around from space to space or can be used permanently in one place. It is simple to set up by plugging in the electrical cord to 110-volt line, attaching hose to the drum that the oil is delivered in, hanging up the thermostat, turning on the switch and the burner and blower fan starts. Since there are no long flues heat is delivered quickly. A regular attendant is not required. Portable units with built-in oil tanks are also available.

This portable furnace is intended for heating large spaces such as airplane hangers, warehouses, garages, holds, piers, shops, sheds, barns, and new construction. It is used to dry newly painted or plastered rooms, concrete, cement, tobacco and other crops that need heat for drying. Other applications are for thawing or preheating of trucks, tractors, and planes.

Furnaces, available in several sizes, all burn No. 2 fuel oil and have stainless steel combustion chambers. A hook on top is provided for lifting complete unit from floor to floor.

For more information, circle on Inquiry Card, **Item 60**

⅛ Hp Electric Dehumidifier

An electric dehumidifier, model 1712, is announced by Airtemp Div., Chrysler Corp., Dayton, Ohio. Known as the Arid-Temp, it is designed to overcome dampness and provide moisture control indoors.

Unit consists of a hermetically sealed compressor which cools a series of coils below room temperature. Untreated air is drawn over the coils by a fan, cooling the air and causing the moisture to condense and drop to a removable receptacle. The unit is capable of reducing excessive humidity in enclosed spaces up to 8,000 cubic feet. Under room conditions of 85 deg and 70% relative humidity, the unit will remove 14 pints of water from the air every 24 hours.

Aluminum-finned tubing is used for the evaporator and condenser coils to minimize odors and prevent corrosion. The compressor, a ⅛ hp reciprocating type is sealed in steel shell by electric welding.

While a large container is provided to catch water, the unit can be permanently connected to a drainpipe or placed over a floor drain if desired. The unit is compact, being 15 inches high, 16½ inches deep and 12 inches wide. It is controlled by an on and off switch and operates on standard 115-volt, 60-cycle current.

For more information, circle on Inquiry Card, **Item 61**

Automatic Rewind Steel Tape

A 50-foot steel tape rule which rewinds automatically is available from Master Rule Mfg. Co., Inc., Middletown, N. Y. Since it can be manipulated in one hand, and since its end-loop can be freed from hook or a half-driven finishing nail by a simple flip of the case at full tape extension, estimators, plumbers, roofers, sheet metal workers, and appliance installation men, may now measure in a single step and without end-mark errors any distance normally encountered in construction.

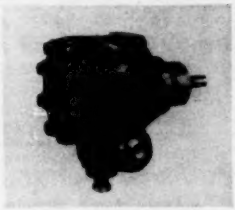
The rule, called the Master Longboy-050, has the added advantage of easy tape replaceability without discarding the case and its internal winding mechanisms when markings are worn after long service. Since the tape is always perfectly coiled in its steel case, even between immediately successive measurements, tap damage due to accidental abuse while lying loose on the job is minimized. Nor is the tape itself exposed to tool-box buffeting.

Simple thumb pressure on the center plate-button starts the rewind; release of this pressure stops the action instantly. Thus, the moving tape is under full control at all times, and only one hand is required for manipulation. It retails for $12. A 100-foot model sells for approximately $16. Alternate 50-foot tapes may be had for $6.

For more information, circle on Inquiry Card, **Item 62**

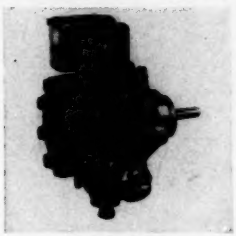
Fuel Units for Oil Burners

New fuel units for use with oil burners have been introduced by Sundstrand Machine Tool Co., Rockford, Ill. One is the single stage Model J (top view) the other the two-stage Model K. Both are available with or without solenoid; models with the solenoid valve are the Models JS and KS, respectively. Latter is shown in bottom view.



Each unit is obtainable in five capacities for maximum firing rates of 3, 6, 9, 14 and 20 gallons per hour with strainers of sufficient size to meet requirements for the top firing rate.

The units incorporate new styling, new strainer, new anti-hum device, decreased over-all length, and hydraulically balanced gears which operate quietly even under high vacuum conditions. The large choice of capacities permits selection of units ideally suited for any line of burners. Better cut-off, as well as starting characteristics, are now obtainable. All units have provisions for either one or two pipe hook-ups, the internal by-pass plug being easy to install through an opening at the bottom of the body.

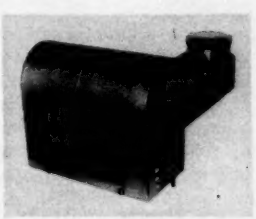


Solenoid valves give instantaneous cut-off. These valves are attached to the top of the body by only two bolts, are positive acting, have conduit openings on each side and connections are readily made to terminals mounted on the coil. True solenoid design assures quiet performance free from electrical hum or chatter. Conventional fuel unit operation may be obtained by simply removing the solenoid plunger. Standard valves incorporate 115 volt, 60 cycle coils although coils for 230 volts, 60 cycles can be furnished on special orders.

For more information, circle on Inquiry Card, **Item 63**

Triple-Mix Head on Gas Burner

A new Combustioneer gas conversion burner has been introduced by Combustioneer Div., The Steel Products Engineering Co., Springfield, Ohio. It is approved for natural, manufactured, mixed, L. P. gases and L. P. gas-air mixtures. Capacity ranges from 50,000 to 225,000 Btu per hour.



The burner features a triple-mix burner head. Primary air and gas are first mixed in the venturi tube inside the burner. As this mixture spreads from the burner head it is sandwiched between two layers of secondary air. The burner head directs the flame towards the sides of the furnace or boiler so that hot gases scrub all the inside heating surfaces for more even heat distribution.

Other features include adjustable legs; telescopic adjustment to increase or decrease the burner length; all controls arranged for easy access within the burner cabinet, and a choice of graduated capacities for precision sizing of the unit to requirements.

For more information, circle on Inquiry Card, **Item 64**

Recessed Gas Wall Heater

In keeping with the demand for modern low-cost heating, Empire Stove Co., Belleville, Ill., introduced at the 10th International Heating and Ventilating Exposition its new, gas-fired Empire recessed heating system. This wall heater allows flexibility for easy installation between standard 16-inch studs, in walls ranging in thickness from 4⅜ inches to 5½ inches without furring.

The units are completely encased and have a spill chamber to prevent products of combustion from discoloring walls. Concealed controls prevent accidental shut-off at any time.

The heaters are available in units with capacities of 25,000 Btu per hour, single wall, 25,000 Btu per hour, dual wall, and 50,000 Btu per hour dual wall, for natural, manufactured or liquefied petroleum gases.

For more information, circle on Inquiry Card, **Item 65**

Steam Control Relief Valve

There has recently been developed an off-center valve of the disc type which simplifies the control of 15 lb per sq in., gage, saturated steam with a low pressure drop.

The valve illustrated, No. 780, is eight inches in diameter and has 150-pound American Standard raised face flanges. A double crank-arm with adjustable weights facilitates accurate setting. The cylinder is not an actuator but simply a dashpot. On the left can be seen a 2-inch flanged outlet for overload relief. It is available from R-S Products Corp., Philadelphia, Pa.

These disc-type valves are available in a range of sizes and for higher pressures as well. They are also used in air, gas, liquid and semi-solid service for the control and shut off of volumes and pressure.

For more information, circle on Inquiry Card, **Item 66**

Picture Window Convectors

Addition of a low-level style convector to its complete line of heating, cooling, and air conditioning equipment is announced by Young Radiator Co., Racine, Wis.

Designed to eliminate picture window drafts, the new FL units are 12 inches high and can be installed out-of-the-way beneath the sill in wall-recessed or free-standing positions. A variety of lengths (20 to 112 inches) and depths (4, 6, and 8 inches) provide ample heat for all requirements in hot water and two-pipe steam systems.

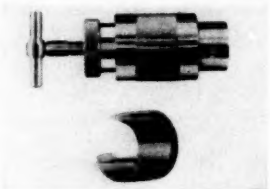
Features include: streamlined compact cabinet styling, with rounded corners and flanged edges to protect children; generous size grille with louvers to direct heat flow out into the room; chain control damper; non-ferrous, tube-and-fin heating element with side plates to strengthen it and protect fins, and cabinet knock-outs and header casting design which permit simplified piping from top and bottom in new or existing hot water or steam (except one-pipe) systems.

For more information, circle on Inquiry Card, **Item 67**

Tool Seals Tube Sheet Closure

A new packing and packing installation tool, both special equipment to a unique new method for sealing tube sheet closures on heat transfer equipment for use with corrosive fluids, have been introduced by Greene, Tweed & Co., North Wales, Pa., and are offered in a combination package called the Palmetto Tube-Seal.

As well as insuring a foolproof seal against all leakage in tube sheet closures, the new method of sealing considerably reduces the high material and installation costs encountered on conventional seals where bolting or threading are involved. Its efficiency also erases the costly downtime commonly experienced for maintenance and replacement of conventional seals.



The packing is of molded composition and is available in compositions that match the service.

This packing, cut to show a cross section, is seen in the lower view to be a deep circular band which, when stretched lengthwise, will conform to the periphery of the tube sheet opening. Its wall is also seen to be separated by a deep-cut V-shaped annular space into which a filler ring (usually of the same material as the tube sheet) is placed before the packing is installed.

The special tool, developed for inserting this packing, is shown in the upper view and consists of two screw drives, the tightening of one causing the tool to grip the edge of the packing and the tightening of the other driving a cylindrical blade forward into the annular space where it contacts the filler ring and, advancing, distends the packing. This stretching thins down the packing walls and so enables the packing to pass over the end of the exchanger tube and to be inserted in the tube sheet opening. When the packing is in place, the tool is removed and the packing, recovering its shape, expands in the opening and exerts pressure radial to the axis of the tube along the length of the filler ring. This pressure produces the seal.

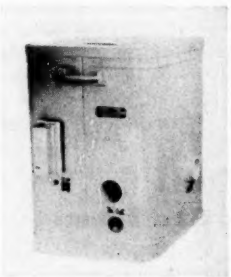
For more information, circle on Inquiry Card, **Item 68**

Package Dehumidifiers, 2 Sizes

Several larger models of dehumidifiers have been added to the Desomatic humidifier line made by Daly, Merritt & Sullivan, Inc., Falls Church, Va. Previously announced were small models suitable for basements and similar applications.

All of the models are of the adsorbent type using silica gel or activated alumina, although other desiccants may be used if desired.

Larger models include the SOR-8 and DOR-38. Former is a single bed type unit intended for storage dehumidification of such products as seeds, grain, flower bulbs, candy, precision instruments, potato chips, drugs and pharmaceuticals. Machine draws reactivation air from outside of the space which is to be kept dehumidified through a separate reactivation circuit. Operation is completely automatic and machine may be controlled by either a plug-in or wall-mounted humidistat. Unit has factory sealed ball bearing fan motor which does not require servicing for 20,000 hours. No other maintenance is required than replacement of the air filter.



Model SOR-8 handles a dry air volume of 25 cfm with a reactivation air volume of 18 cfm. It will remove 8.1 lb of water per day at 95F dry bulb and 75% relative humidity or 1½ lb per day at 40F dry bulb and 15% relative humidity and with corresponding capacities at intermediate conditions.

The DOR-38 (both illustrations) is a dual bed unit in which one bed is reactivating while the other bed is drying the air. Capacity of this unit is 70 cfm dry air volume and 35 cfm reactivation air volume. Thus unit will remove 38 lb of water per day at 95F dry bulb and 75% relative humidity down to 12 lb per day at 40F dry bulb and 35% relative humidity.

For more information, circle on Inquiry Card, **Item 69**

PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on:

- **News of Equipment and Materials**
- **New Catalogs**

Circle the Item Number in which you are interested and print clearly your name and address with title.

NEW CATALOGS

CONDENSER CIRCULATORS

Condenser circulators, in standard sizes to 100,000 gpm and in special sizes to 200,000 gpm, are illustrated and described in catalog No. G-1050, issued by Economy Pumps, Inc., Div. of Hamilton-Thomas Corp., Hamilton, Ohio. Designed for power station service, the pumps described are vertical, mixed-flow units of large capacity and low head. They are said to be capable of handling larger volumes of water at lower cost than any other type of efficient pumping equipment. New "pull-out" type units are also illustrated in the catalog. These units permit removal of all operating parts without pulling out the complete pump or disturbing any of the pipe connections. ..... Item 70

FLOAT TRAP BULLETIN

Bulletin 950 on its float traps has been issued by the V. D. Anderson Co., Cleveland, Ohio. It gives complete specifications, capacities, pressures, sizes, and price lists of the three principal float traps manufactured by the company, Models D, F, and Junior. Float traps are widely used to drain condensate from steam equipment as well as moisture from air and gas equipment. Detailed information is given on these applications. Cross sections of float traps, air release valves, strainers and Super-Silvertop steam traps are shown..... Item 71

SMALL FEEDWATER HEATER DATA

A 2-page bulletin, S-201-A, describing the new all steel Swartwout junior feedwater heater for preheating feedwater supply in small power plants at 300 hp or less, is announced by The Swartwout Co., Cleveland, Ohio. ..... Item 72

ANTI-CORROSION COATING

Corrosion resistance and economy are claimed for Zincilate, a one-coat, self-protecting, anti-corrosion coating described in an 8-page illustrated technical bulletin, No. 100, published by Industrial Metal Protectives, Inc., Dayton, Ohio. Bulletin presents case histories, specifications, and data on surface preparation and methods of application..... Item 73

BI-METAL THERMOSTATS

A new bulletin, No. F2009, describing its Type M bi-metal disc thermostats for use in appliance, electronic, avionic and apparatus applications, is announced by Stevens Mfg. Co., Inc., Mansfield, Ohio. The bulletin, which stresses the quick make and break operation of these thermostats, is illustrated with photographs of standard and hermetically sealed models, dimensions, schematic diagram showing operating principle, and typical thermostat response curves..... Item 74

STEEL TUBING DATA CARD

A technical data card, TDC136, on the chemical compositions of the company's seamless alloy steel tubing, specifically B&W Croloy steels of the low and intermediate alloy groups, has been issued by The Babcock & Wilcox Tube Co., Beaver Falls, Pa. These data apply to pipe for high-temperature service and tubing for use in heat exchangers, condensers, refinery stills, boilers and superheaters. Data covers carbon, manganese, phosphorus, sulphur, silicon, chromium and molybdenum content, according to ASTM specifications. ..... Item 75

WATER PRESSURE REDUCING VALVE

A 6-page bulletin, W-3, containing complete technical information on its cushioned water pressure reducing valve is available from Golden-Anderson Valve Specialty Co., Pittsburgh, Pa. Bulletin features the general arrangement of the valve and with a detailed list of parts. Installation, operation, adjustment, servicing and specifications are fully described, along with tables showing general dimensions, approximate shipping weights and general list of materials. ..... Item 76

COMPLETE CONTROL CATALOG

Catalog 700, 64 pages, and covering its complete line of mercury-switch equipped automatic controls, has been issued by Mercoid Corp., Chicago, Ill. Although an astonishingly large number of controls are comprehensively covered in this book, the typography and arrangement are so skillfully done that there is no evidence of crowding nor has clearness in presenting drawings, specifications and prices been slighted in any way. The descriptions are uniform in style, which adds considerably to the ease in locating a given piece of equipment..... Item 77

STEAM SPECIALTY CATALOG

A 33-page catalog, with complete descriptive matter on its steam and air traps, pressure reducing valves, pump governors, pressure regulators, boiler feed controls and temperature regulators, has been issued by The C. E. Squires Co., Cleveland, Ohio. Also included are data for sizing this equipment, trap capacity tables, reducing valve selection charts, and reducing valve capacities..... Item 78

UNIT COOLERS

A 2-page bulletin, C-5 102, featuring its unit coolers, Baby Flacold, models F-125 to F-271, and describing features, dimensions and ratings, is available from Drayer-Hanson, Inc., Los Angeles, Calif. These coolers are designed for bottle coolers, pie and salad cases, back-bar, reach-in refrigerators and other small applications requiring temperatures of above 34 degrees. ..... Item 79

REGISTER AND GRILLE DATA

All necessary data for sizing and selection of registers, grilles and ceiling diffusers are included in the technical data sections of a 44-page catalog, No. 51, published by Hart & Cooley Mfg. Co. Holland, Mich. It also includes free area, weights, dimension and price information on the company's complete line of registers, grilles and furnace accessories. ..... Item 80

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DATA ON SPIRAL PIPE

Bulletin 507, showing typical applications of its Lockseam Spiralweld pipe in the construction, dredging, material handling, mining, oil, paper mill, power plant, and sewage disposal fields, has been published by Naylor Pipe Co., Chicago, Ill. It includes data on fittings, flanges, connections, and pipe specifications from 4 to 30 inches in diameter. ..... **Item 81**

NEW REFRIGERATION OILS

A new series of refrigeration oils for higher-operating temperature air-conditioning and refrigerating equipment has been announced by Sun Oil Co., Philadelphia, Pa. Suniso 300 oils, especially refined and processed to keep the newer, better running compressors sludge-free and operating at peak efficiency, are described in a folder entitled New Refrigeration Oils for Higher Operating Temperatures. ..... **Item 82**

SWING JOINTS FOR PIPING

Flexible Ball Joints is the title of a new 16-page bulletin 215 published by Barco Mfg. Co., Chicago, Ill. Bulletin contains complete specifications, dimensions, and application data for the company's entire line. ..... **Item 83**

INDICATORS AND CONTROLLERS

A new condensed catalog, Bulletin Z6600, has been released by Wheelco Instruments Co., Chicago, Ill. It covers a selection of typical Wheelco indicators, controllers and combustion safeguards which are illustrated and briefly described. An accompanying 4-page price list contains the listing, description and current price applying to nearly all of the standard instruments manufactured by this company. ..... **Item 84**

RADIANT GLASS PANELS

A 4-page standard size bulletin entitled Radiant Glassheat has been published by Continental Radiant Glass Heating Corp., New York, N. Y., and devoted to the company's electrically heated glass panel units. Definitions, uses, applications, installation, descriptive and capacity data and specifications are included. ..... **Item 85**

PACKAGED AIR COOLING UNITS

A promotional booklet, die-cut as a detailed sectional representation of its packaged refrigerated Kooler-aire equipment, has been issued by United States Air Conditioning Corp., Minneapolis, Minn., to illustrate graphically the features of this compact unit. The double-flap cover of the odd-shaped booklet is a cut-out photo of the unit and opens outward to reveal a sectionally-cut picture of the equipment's interior. The part depicting each of the unit's basic components also opens separately to reveal a description of each section, conditioner, compressor and evaporative condenser. Remainder of booklet provides installation diagrams and instructions, general specifications and capacities of the equipment, a breakdown of its parts, instructions for its adaptation to perform an added heating function, and a statement of its economical features. **Item 86**

100th ANNIVERSARY BOOKLET

An interesting and comprehensive anniversary booklet has been published by Grinnell Corp., Providence, R. I., in commemoration of its hundredth anniversary. The company's history, from its beginning as the Providence Steam and Gas Pipe Company, is traced in brief, followed by photographs of the company's plants, as well as installation of its various divisions. ..... **Item 87**

HOME WIRING HANDBOOK

The third edition of the Home Wiring Handbook (B-3510-B), a 135-page guide for planned wiring of homes in the popular-priced group, is available from Westinghouse Electric Corp., Pittsburgh, Pa. As a modernized expansion of the second edition, the Handbook goes beyond minimum code standards. It describes four degrees of electrical living. The first degree lists "musts" in electrical equipment for the home; and successively, the second, third, and fourth degrees list further refinements for better electrical living. Eleven chapters cover every phase of house wiring for each degree, including minimum outlet requirements for each room, selection of number and type of circuits, circuit protection and communication systems. It is priced at $1. ..... **Item 88**

COMPLETE VALVE CATALOG

Valve catalog 50V, 112 pages, describing for the convenience of all specifications writers and purchasers the company's line of bronze and iron body valves, has been published by Stockham Valves and Fittings, Birmingham, Ala. This catalog has been planned for quick, easy reference. Listings are complete and include photographs, dimensional diagrams, price, weight, sizes and dimensions. Thus time-wasting reference to other pages is eliminated. ..... **Item 89**

MICROFILMING DESIGN DRAWINGS

A 12-page illustrated booklet, Facts and Figures on Microfilming Engineering Drawings, has been issued by Micro-Photo Service Bureau, Cleveland, Ohio. It presents pertinent information for the executive responsible for the safekeeping of important company drawings and other records. The publication discusses the importance of microfilming, costs, equipment, film storage, film processing and related subjects. ..... **Item 90**

LOW HEIGHT CONVECTORS

Catalog 4150, on its line of low-level convectors for hot water and two-pipe steam heating systems, has been issued by Young Radiator Co., Racine, Wis. The eight-page, two-color piece is a supplement to Catalog 4048 which gives details on its general line of convectors. Full details on design and construction features, roughing-in dimensions, ratings, and architects' specifications are included. ..... **Item 91**

GAS AND ELECTRIC WATER HEATERS

Three standard size looseleaf sheets have been issued by Premier Heater Div., Bastian-Morley Co., Inc., LaPorte, Ind., and covering the company's Crane-Line Selectric automatic electric water heater and Superior, Keystone and Champion gas water heaters. Sheets include descriptive and illustrative material, complete specifications, and dimensional and capacity data. ..... **Item 92**

GAS-FIRED FURNACE

A 6-page standard size bulletin 505 is published by Armstrong Furnace Company, Columbus, Ohio, and devoted to its gas-fired winter air conditioner available in three sizes with capacities of 68,000, 84,000 and 112,000 Btu per hour output. ..... **Item 93**

ALUMINIZED STEEL

Steel with a special coating of aluminum is discussed in a new booklet published by Armco Steel Corp., Middletown, Ohio. The illustrated 24-page booklet, Armco Aluminized Steel, describes the steel's aluminum surface, its heat and corrosion resistance and outstanding heat reflectivity—80% up to 900F. Photographs and a listing of applications show where manufacturers have used Aluminized steel in a wide variety of products. Also included are data on mechanical and forming properties, available sizes and gages, and detailed recommendations for welding by various methods, brazing and finishing. ..... **Item 94**

BOILER CONTROLS

A new bulletin, SLC-2-F, covering all of the various types of boiler controls manufactured by Penn Electric Switch Co., Goshen, Ind., includes boiler controls for temperature, pressure and vapor applications, and gives complete ordering specifications for all of the six basic types of boiler controls manufactured by Penn. Specifications include type designations, application information, temperature element and I.P.T. connector sizes, electrical specifications, as well as roughing-in dimensions. ..... **Item 95**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

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11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
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51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
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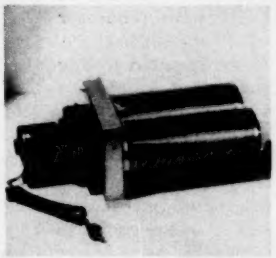
New, Unusual, or Ingenious Uses of Equipment and Materials

Carbon Canisters Form Air Pollution Test Unit

PROBLEM: One of the common problems in air sampling is the determination of the prevailing concentration of gaseous and vaporous contaminants. Most sampling techniques use specific reactants for some one particular substance. It is frequently desired, however, to test for a variety of substances in a given sample of air.

SOLUTION: By introducing the sample of air through activated carbon, most of the gaseous and vaporous contaminants are adsorbed and subsequently are determined qnantitatively by chemical analysis. W. B. Connor Engineering Corp. has devised a collecting apparatus which will induce a known volume of contaminated air through a predetermined quantity of granular activated carbon. Device consists of two perforated carbon filled canisters assembled with a motor driven air blower. Control of the blower is such that by operating the unit for a known duration the volume of air sampled can be determined.



RESULTS: Activated carbon collects most air impurities in such a manner that subsequent analysis can determine both quality and quantity of contaminants. Even distribution of air throughout the canister permits dividing carbon into several samples for a variety of tests. For instance, one sample may be used to establish the moisture-borne contaminants, while another is used to determine non-aqueous organic substances.

Metallizing Stops Corrosion

PROBLEM: Two steel 15,000-gallon gravity sprinkler tanks in the General Mills plant in Buffalo, N. Y., had become very pitted by corrosion to the extent that 20 to 30 percent of the metal on rivet heads had been lost. Also, there were deep scars and cavitations throughout the entire interior surface.

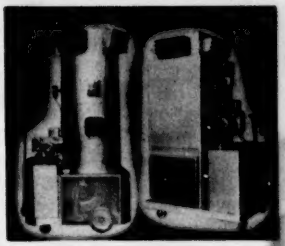
SOLUTION: In October, 1934, about .006 inch of zinc was applied by Metalizing Engineering Company, Inc., of Long Island City.

RESULTS: The tanks, which contained water drawn from the city canal, were inspected on June 28, 1950, and found in excellent condition with no trace of corrosion on any of the plates, including the bottom. Since the average thickness of zinc at present is about .004 inch, it is expected that the protection should last another 15 to 20 years.

Mobile Heating Units for Outside Jobs

PROBLEM: For heating on construction jobs, quarries and other temporary applications, it is frequently convenient to have a movable heat source so that work can proceed unhindered by freezing temperatures.

SOLUTION: To meet this type of situation, portable Thermoblocs, manufactured by Prat-Daniel Corp. of East Port Chester, Conn., have been mounted on easy operating trucks which also carry the fuel tank. Units provide 100,000 to 300,000 Btu per hour, and a Model 1000 is available providing an output of 1,000,000 Btu per hour.

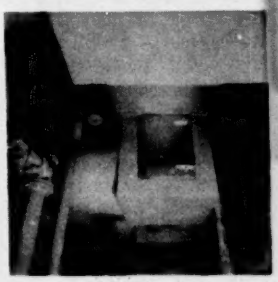


RESULTS: Equipment is said to be more efficient and less space consuming than salamanders or other conventional methods in use. Also, the heater may be moved about to provide most effective diffusion.

Air Gap Simplifies Duct Insulation

PROBLEM: Heating engineers for the School District of the City of McKeesport, Pa. were faced with the problem of a large duct insulating job. Much of the cost of installing insulation was in cutting and notching of insulation blocks to fit around obstructing duct reinforcements.

SOLUTION: Instead of applying insulation directly to duct surfaces, insulation is spaced 2 inches out from the duct. This removes it from the interference of duct stiffeners. Installation involves wiring to angle-iron members running the length of the ducts. These members are welded to angle-iron stiffeners surrounding the ducts. To complete the job, mineral wool blocks are covered with a ¾-inch mineral wool cement coat trowelled into 1-inch wire mesh stretched over the blocks. The exterior is covered with a 10 oz canvas and painted.

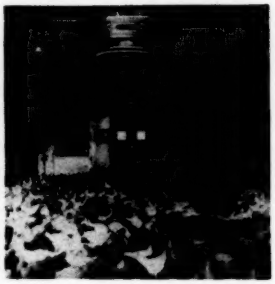


RESULTS: Cutting and notching of insulation blocks is eliminated and wasting of cut off pieces in avoided. Thermal efficiency of the insulation is increased by the air space between duct and insulation.

Unit Heaters Brood Chicks

PROBLEM: Mass production techniques in growing chickens have forced growers to seek methods adequate for brooding 40,000 to 100,000 chickens from birth to broiler stage without resorting to relocation of poultry or redesign of enclosure.

SOLUTION: Over a thousand vertical Modine unit heaters are in use in various mid-western installations ranging in size from 4 to several hundred heaters on a single job. Vertical delivery units are equipped with Connor's Kno-Draft adjustable diffusers. In a system devised by Russell Smith, Modine St. Louis representative, who has worked closely with large broiler growers in developing what is now known as the Modine live air brooder house heating. In some installations Modine horizontal heaters are used.

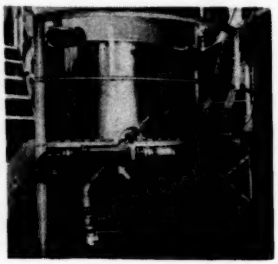


RESULTS: The use of Modine unit heaters provides uniform draftless heating with adequate air circulation required for healthy chicks and dry litter. Crowding under hovers is eliminated to reduce mortality rates. Labor, litter, and fuel costs are less. Weight gains of as much as ¾ lb per bird above normal gain have been attributed to the use of Modine live air heating.

Scraper Strainer Boosts Chocolate Output

PROBLEM: The H. Fox Company, Inc., of Brooklyn, N. Y., found that hardened chocolate syrup particles quickly clogged strainers in syrup pipe lines, causing frequent shutdown to remove strainer screens. Restricted flow caused back pressure, forcing some particles through overloaded screens.

SOLUTION: Sarco scraper strainers were installed in the chocolate syrup pipe lines. Inside the cylindrical screen of each strainer is a scraper blade which rotates like a worm gear. Blade hugs the inside of the screen and scrapes off the hard chocolate particles while the syrup is pouring through the strainer.

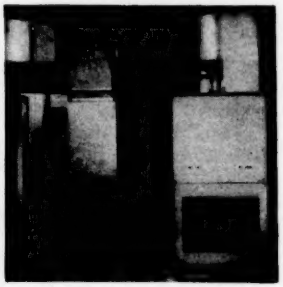


RESULTS: There are no longer any shutdowns to clean screens. Screens do not become overloaded and therefore no particles are forced through by back pressure. Since strainers are continuously scraped and cleaned, a closer mesh can be used to remove the smallest particles of hardened syrup.

Year-Round Air Conditioning for Store in Tall Building

PROBLEM: The problem of air conditioning a ground floor and basement store area in a tall building without wasting valuable floor area or city water was faced by the new Joseph Shulster's Men's Clothing Store in New York City.

SOLUTION: As a means of conserving both floor space and city water, the system utilized a 15-ton U. S. Air Conditioning Corp. Kooler-Air self-contained packaged unit which has been placed in the corner of a basement workroom. The unit contains an evaporative condenser which saves about 95% of the required cooling water and avoids the difficulty of installing a roof tower atop the 20-story building in which the store is located. Outside air is introduced to the system through the transom above the entrance door to concealed duct work which was integrated into the over-all design of the main floor section of the store. Heat from window display lights is handled by a separate supply and exhaust system which blankets off excess heat from the sales area. To furnish winter heating, the unit's heating coil has been connected to the building's main steam supply.



RESULT: Winter heating and summer cooling with automatic zoned temperature control maintain desired conditions despite varying loads. Conditioned air is distributed through ducts to grilles in the main ceiling area, basement workroom, fitting rooms, and offices.

Air Conditioning Equipment Placed Outdoors to Save Space

PROBLEM: When the management of the Juarez Furniture Store in Laredo, Texas, decided to install air conditioning it was faced with the problem of placing the equipment so that no floor space would be sacrificed. The store has no basement, and its roof is incapable of supporting either an air conditioning unit or a cooling tower.

SOLUTION: Air conditioning equipment was placed on a rear porch with a partial concrete floor. The concrete slab was extended and reinforced to support a U. S. Air Conditioning Corp. 15-ton Kooler-Aire unit. The unit is completely enclosed and fitted for outdoor installation and contains an evaporative condenser which eliminates the need for a cooling tower. The unit was connected by duct work to grilles in the main store area and on a balcony within the store.

RESULTS: The entire installation was carried out without interruption of normal operation of the store. The owner reports a substantial increase in business in spite of a general business decline in the area. The store is cooled without sacrificing valuable display floor space.

In these times of scarcities
it is more than ever important to remember
that two or more heads are better than one.
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about their materials, how to select, specify and fabricate them.
No matter what you buy, it will pay you
to draw upon this knowledge.
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DEGREE-DAYS FOR DECEMBER, 1950

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city

HEATING AND VENTILATING's 23rd Year of Publication of Monthly Degree-Day Data

City	December			Cumulative, September 1 to December 31			Heating Season[1]
	1950	1949	Normal	1950	1949	Normal	Normal
Abilene, Texas (A)	635	513	592	996	870	925	2061
Albany, New York (A)	1218	1098	1147	2520	2486	2439	6580
Albuquerque, New Mexico (A)	697	958	924	1239	1680	1827	4298
Alpena, Michigan (C)	1279	1142	1247	2864	2729	2951	8299*
Anaconda, Montana (C)	1065	1302	1238	3093	3143	3171	8357**
Asheville, North Carolina (C)	931	677	837	1785	1531	1689	4232
Atlanta, Georgia (C)	749	600	639	1319	1079	1131	2890
Atlantic City, New Jersey (C)	870	756	893	1587	1432	1735	5176
Augusta, Georgia (A)	699	446	549	1192	780	886	2161
Baker, Oregon (C)	918	1122	1156	2374	2632	2815	7163
Baltimore, Maryland (C)	894	728	874	1599	1361	1664	4533
Billings, Montana (A)	1035	1315	1194	2714	2760	2816	7119
Binghamton, New York (C)	1219	1021	1256	2529	2314	2515	6808
Birmingham, Alabama (A)	772	548	595	1351	1042	913	2352
Bismarck, North Dakota (A)	1640	1711	1553	3648	3405	3514	9192
Block Island, Rhode Island (A)	862	798	884	1726	1628	1736	5788
Boise, Idaho (A)	884	1051	1011	1949	2330	2285	5552
Boston, Massachusetts (A)	905	872	1026	1847	1851	2130	6045
Bozeman, Montana (C)	1127	1261	1293	3159	3049	3286	8521**
Buffalo, New York (A)	1168	983	1104	2424	2273	2372	6822
Burlington, Iowa (A)	1379	1041	(a)	2601	2166	(a)	(a)
Burlington, Vermont (A)	1242	1139	1287	2717	2664	2773	7514
Butte, Montana (C)	1123	1366	1261	3240	3276	3183	8235**
Cairo, Illinois (C)	954	663	822	1698	1317	1499	3909
Canton, New York (C)	(a)	1185	1342	(a)	2815	2994	8020
Charleston, South Carolina (C)	585	349	425	920	585	632	1769
Charlotte, North Carolina (C)	780	613	679	1357	1130	1220	3120
Chattanooga, Tennessee (A)	839	673	694	1511	1299	1225	3118
Cheyenne, Wyoming (A)	965	1160	1144	2529	2639	2889	7466
Chicago, Illinois (C)	1271	962	1074	2341	1982	2172	6077
Cincinnati, Ohio (C)	1054	743	927	1946	1511	1796	4684
Cleveland, Ohio (A)	1231	956	1060	2382	2075	2185	6155
Columbia, Missouri (C)	1068	839	985	2026	1690	1896	4922
Columbia, South Carolina (C)	682	492	561	1144	876	916	2364
Columbus, Ohio (C)	1176	867	1017	2225	1820	2020	5398
Concord, New Hampshire (A)	1129	1147	1234	2562	2706	2732	7353
Concordia, Kansas (C)	1032	1024	1050	1989	1847	2019	5315
Dallas, Texas (A)	571	459	567	923	774	870	2256
Davenport, Iowa (C)	1385	1033	1175	2519	2111	2333	6289
Dayton, Ohio (A)	1271	926	1014	2445	2035	1947	5264
Deer Lodge, Montana (C)	1167	1325	1331	3310	3241	3518	8672**
Denver, Colorado (C)	885	923	1017	1983	1875	2276	5874
Des Moines, Iowa (A)	1387	1118	1215	2585	2173	2370	6384
Detroit, Michigan (A)	1218	993	1113	2457	2227	2332	6490
Devils Lake, North Dakota (C)	1815	1855	1710	4033	3788	3871	9970
Dodge City, Kansas (A)	925	956	1004	1840	1746	1952	5035
Dubuque, Iowa (C)	1443	1150	1243	2694	2373	2534	6790
Duluth, Minnesota (C)	1699	1566	1519	3738	3411	3489	9483
Eastport, Maine (C)	1004	1038	1228	2496	2537	2890	8520**
Elkins, West Virginia (A)	1169	892	1035	2478	2142	2217	5697
El Paso, Texas (A)	456	653	617	779	1069	1038	2428
Ely, Nevada (A)	927	1291	(a)	2444	2858	(a)	(a)
Erie, Pennsylvania (C)	1131	900	1039	2232	1971	2164	6273
Escanaba, Michigan (C)	1413	1244	1344	3162	2920	3138	8771
Evansville, Indiana (A)	1100	764	862	2010	1618	1545	4244
Fort Smith, Arkansas (A)	835	658	707	1420	1240	1177	3147
Fort Wayne, Indiana (A)	1342	983	1138	2617	2206	2211	5925
Fort Worth, Texas (A)	576	472	574	917	806	826	2148
Fresno, California (A)	428	645	577	690	1024	911	2334
Galveston, Texas (C)	254	190	270	389	271	330	1016
Grand Junction, Colorado (A)	913	1101	1162	1806	2185	2278	5548
Grand Rapids, Michigan (A)	1276	994	1147	2625	2220	2397	6535
Green Bay, Wisconsin (C)	1580	1279	1324	3271	2923	2882	7825
Greensboro, North Carolina (A)	903	725	760	1687	1432	1395	3529
Greenville, South Carolina (A)	794	643	738	1399	1223	1334	3380
Harrisburg, Pennsylvania (A)	1074	913	992	2108	1880	1981	5375
Hartford, Connecticut (A)	1024	1020	1060	2129	2137	2157	6036
Hatteras, North Carolina (C)	639	401	493	940	688	727	2571
Havre, Montana (C)	1262	1678	1383	3235	3239	3314	8700
Helena, Montana (A)	1187	1395	1245	3252	3241	3058	7894**
Houston, Texas (C)	279	239	335	450	358	449	1157
Huron, South Dakota (A)	1508	1410	1431	3167	2861	3085	8004
Indianapolis, Indiana (A)	1281	903	1017	2413	1961	2002	5298
Jackson, Mississippi (A)	636	410	(a)	1046	754	(a)	(a)
Kansas City, Missouri (A)	1056	866	1008	1926	1599	1866	4956
Knoxville, Tennessee (A)	912	680	781	1659	1355	1483	3670
La Crosse, Wisconsin (A)	1591	1344	1311	3109	2818	2778	7322
Lander, Wyoming (A)	1023	1377	1419	2815	3039	3075	7947

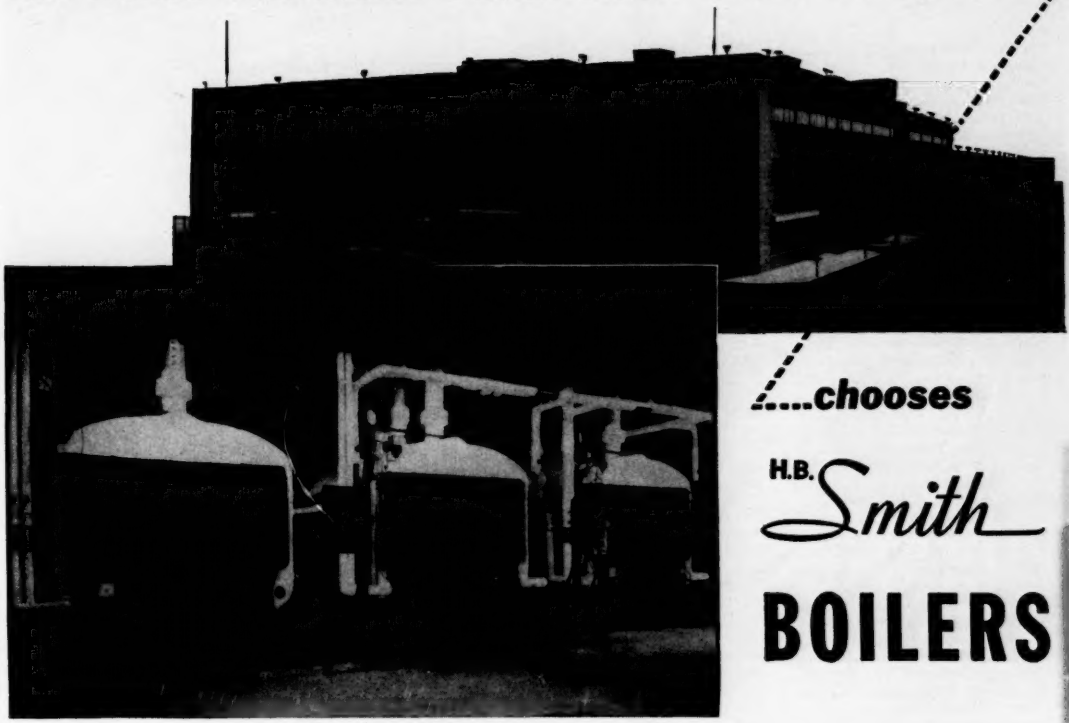
(a) Data not available.

[1]Figures in this column are normal totals for a complete heating season, September to June, inclusive.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y., and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.

[Table concluded on page 1401]

The WORLD'S LARGEST UNION motor truck terminal.....



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BOILERS

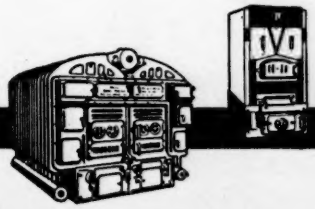
Battery of three No. 60-S-17 H. B. Smith oil-fired cast iron boilers, each with net steam rating of 12,925 sq. ft. Owner, Architects and Engineers of Terminal: The Port of New York Authority, New York. Heating Contractors: August Arace & Sons, Inc., Elizabeth, New Jersey.

To assure trouble-free heating and hot water supply, The Port of New York Authority selected H. B. Smith cast iron boilers in the new Union Motor Truck Terminal at Newark, N. J.

For the 31,000 feet of steam radiation, three No. 60-S-17 Smith oil-fired cast iron boilers do an eminently competent job, as does the No. 340-W-11 Mills boiler in the adjacent maintenance building.

In winter, four No. 608 Smith Manifold Indirect Heaters provide a total hot water capacity of 1680 GPH at 100°F. temperature rise, while in summer, one No. 34-W-11 Smith oil-fired unit with capacity of 1596 GPH is adequate.

H.B. Smith



SINCE 1853 CAST IRON BOILERS

THE H. B. SMITH CO., INC., WESTFIELD, MASS.

Most complete line in the world of cast iron boilers for heating

Degree-Days for December, 1950 (Concluded)

(A) Airport readings; (C) City office readings; (O) Readings at a point on outskirts of city.

HEATING AND VENTILATING's 23rd Year of Publication of Monthly Degree-Day Data

City	December			Cumulative, September 1 to December 31			Heating Season[1]
	1950	1949	Normal	1950	1949	Normal	Normal
Lansing, Michigan (A)	1305	1052	1209	2723	2505	2665	7048
Lewiston, Maine (O)	1074	1107	1295	2542	2585	2837	7707
Lincoln, Nebraska (C)	1160	1076	1132	2263	2012	2201	5999
Little Rock, Arkansas (A)	805	594	651	1364	1074	1079	2811
Livingston, Montana (C)	949	1169	1117	2744	2648	2731	7245**
Los Angeles, California (C)	114	294	301	220	414	424	1504
Louisville, Kentucky (A)	1066	729	849	1958	1532	1587	4180
Lynchburg, Virginia (A)	936	753	800	1778	1503	1557	3980
Macon, Georgia (A)	646	466	567	1095	829	897	2201
Madison, Wisconsin (C)	1473	1202	1321	2866	2546	2758	7429
Marquette, Michigan (C)	1360	1268	1302	3121	2950	3054	8693*
Memphis, Tennessee (A)	844	581	663	1458	1146	1127	2950
Meridian, Mississippi (A)	673	462	549	1143	875	883	2160
Milwaukee, Wisconsin (A)	1437	1126	1221	2830	2487	2601	7245
Minneapolis, Minnesota (A)	1627	1384	1404	3198	2807	2941	7850
Montgomery, Alabama (A)	670	418	496	1132	722	769	1884
Nantucket, Massachusetts (A)	859	825	905	1851	1811	1912	5957
Nashville, Tennessee (A)	945	670	744	1709	1342	1363	3507
New Haven, Connecticut (A)	980	933	1017	1998	1954	2109	5895
New Orleans, Louisiana (C)	358	223	301	577	368	403	1024
New York, N. Y. (C)	924	767	940	1704	1495	1856	5274***
Nome, Alaska† (A)	1263	1228	1509	2822	2769	3379	14580**
Norfolk, Virginia (C)	753	545	685	1238	963	1195	3350
North Head, Washington (C)	507	682	654	1700	1690	1785	5452**
North Platte, Nebraska (A)	1065	1124	1173	2400	2331	2486	6366
Oakland, California (A)	273	569	496	627	1074	1099	3143**
Oklahoma City, Oklahoma (C)	774	705	815	1347	1219	1379	3613
Omaha, Nebraska (A)	1252	1088	1175	2407	2096	2284	6131
Oswego, New York (C)	1166	1020	1138	2426	2283	2494	7088
Parkersburg, W. Virginia (C)	1062	807	921	2048	1700	1830	4775
Peoria, Illinois (A)	1364	984	1150	2542	2100	2323	6109
Philadelphia, Pennsylvania (C)	916	753	884	1676	1458	1699	4737***
Phoenix, Arizona (C)	183	386	425	240	465	581	1405
Pittsburgh, Pennsylvania (C)	1084	841	967	2168	1774	1949	5235
Pocatello, Idaho (A)	1004	1180	1181	2393	2684	2649	6655
Portland, Maine (A)	1096	1081	1159	2591	2601	2605	7218
Portland, Oregon (C)	516	694	729	1468	1554	1724	4469
Providence, Rhode Island (C)	915	867	1026	1862	1842	2130	6015
Pueblo, Colorado (A)	936	992	1029	1960	1983	2164	5514
Raleigh, North Carolina (C)	789	580	694	1371	1067	1253	3234
Rapid City, South Dakota (A)	1116	1331	1172	2677	2638	2701	7118
Reading, Pennsylvania (C)	1008	836	1001	1914	1717	2014	5389
Red Bluff, California (A)	498	639	(a)	859	962	(a)	(a)
Reno, Nevada (A)	810	1037	973	1945	2329	2284	5892
Richmond, Virginia (C)	849	660	763	1541	1234	1380	3695
Rochester, New York (A)	1191	1026	1125	2463	2372	2414	6732
Roseburg, Oregon (C)	(a)	724	719	(a)	1615	1741	4428
Roswell, New Mexico (A)	663	807	808	1180	1450	1510	3484
Sacramento, California (C)	442	628	574	727	1001	996	2653
St. Joseph, Missouri (A)	1146	1000	1079	2137	1880	1960	5161
St. Louis, Missouri (C)	1087	741	936	1983	1466	1738	4585
Salt Lake City, Utah (A)	912	1077	1020	1969	2279	2149	5555
San Antonio, Texas (A)	377	296	347	601	441	473	1202
San Diego, California (A)	160	313	288	284	454	487	1645
Sandusky, Ohio (C)	1206	919	1063	2282	1913	2142	6208
San Francisco, California (C)	345	448	428	705	933	949	3264**
Sault Ste. Marie, Michigan (A)	1435	1329	1370	3338	3241	3247	9285**
Savannah, Georgia (A)	581	326	397	939	587	598	1490
Scranton, Pennsylvania (C)	1124	976	1085	2259	2141	2274	6129
Seattle, Washington (C)	520	722	719	1570	1672	1869	4934**
Sheridan, Wyoming (A)	1078	1339	1320	2784	2853	3198	8008
Shreveport, Louisiana (A)	594	428	499	958	759	769	1938
Sioux City, Iowa (A)	1362	1221	1265	2721	2438	2583	6898
Spokane, Washington (A)	966	1155	1057	2528	2667	2583	6355
Springfield, Illinois (C)	1249	864	1039	2275	1748	2002	5373
Springfield, Missouri (A)	1001	806	893	1927	1674	1674	4428
Syracuse, New York (A)	1241	1038	1172	2515	2324	2491	6893
Tacoma, Washington (C)	549	767	756	1713	1821	1951	5181**
Terre Haute, Indiana (A)	1290	877	992	2397	1897	1840	4872
Toledo, Ohio (A)	1293	987	1079	2551	2208	2189	6077
Topeka, Kansas (C)	1038	929	1008	1898	1694	1883	4969
Trenton, New Jersey (C)	971	824	930	1857	1697	1760	4933
Utica, New York (O)	1262	1125	1144	2640	2349	2537	6796
Valentine, Nebraska (C)	1185	1235	1245	2651	2571	2725	7039
Walla Walla, Washington (C)	741	816	896	1796	1841	1909	4808
Washington, D. C. (C)	907	718	896	1631	1391	1741	4626
Wichita, Kansas (A)	937	861	955	1736	1564	1783	4673
Williston, North Dakota (C)	1578	1750	1591	3650	3537	3658	9323
Winnemucca, Nevada (C)	837	1142	1080	2113	2537	2859	6427**
Yakima, Washington (A)	931	973	1091	2356	2288	2428	5599

(a) Data not available.

†Nome data are for November.

*Includes August.
**Includes July and August.
***New 48-year normal covering 1898 to 1946.

[1]Figures in this column are normal totals for a complete heating season, September to June, inclusive.

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MORE MEDIA • HOLDS MORE DIRT • EASIER TO CLEAN
HERRINGBONE-CRIMP MEDIA DESIGN • HANDLES 50% MORE AIR PER UNIT
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Every claim made for FAR-AIR Filters can be proved by you with a simple test. For complete information, write to Farr Company, 2615 Southwest Drive, Los Angeles, California.

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We doubt that you've done much work for the Three Bears lately.

We haven't, either.

But we *can* help heating engineers and contractors provide the proper thermal environment for any client—anywhere—in any kind of structure.

We have a lot of literature on all phases of heating, ventilating and air conditioning. Information you should have in your files.

And we have a lot of very well informed control engineers—in our 89 different offices—who have a lot *more* information right at their finger-tips.

We sincerely believe we can help you on any project that poses problems of control of any kind—for *control* is Honeywell's business.

So, why not *talk to Honeywell?* Why not *write* to Honeywell for complete information on the equipment discussed in the column across the page? And why not do it *now?*

MINNEAPOLIS **Honeywell**

First in Controls

WASHINGTON NEWS

(Continued from page 75)

(defense orders). Percentages vary from product to product, and are designed to insure that the requirements of the expanding rearmament program will be met. The order also specifies minimum mill quantities which must be ordered on "DO" orders for other defense-supporting programs authorized by NPA—the freight car program and oil fields program, for example. The amended order also brings under control for the first time (in the present emergency) the following: steel castings and forgings, wire rope and strand welded wire fabrics, wire netting, pig iron, and malleable and gray iron castings (except cast iron soil pipe and pressure pipe).

Nickel and Tungsten Controlled

Order M-30 provided for the complete allocation of tungsten, effective March 1. Tungsten has been obtained primarily in Red China, and the current altercations with that government has shut off all supplies from that source. As is so often the case when an order is issued to restrict end uses of a product, the public learns for the first time that the restricted product has uses not generally known. The tungsten order, for example, provides end use restrictions on the use of the product in the manufacture of grinding wheels and in pigments and printing and lithographic inks. The order also restricts the use of tungsten in the manufacture of high speed steels.

Also effective March 1 is an NPA order banning the use of nickel in automobile trim and in 400 other civilian products. In announcing the ban, NPA permits no new starts on the specified products after March 1 if nickel silver or nickel plate is to be used, or after April 1 if nickel-bearing stainless steel or high-content nickel alloys are to be used. However, NPA allows manufacturers two months to complete articles started before the effective dates.

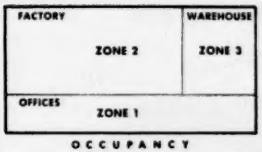
Small Business Outlook Scanned

Chances are considered good for the passage of legislation to set up a Small Defense Plant Corporation to aid small business in its efforts to participate in the defense program. Bills to provide for such a corporation have been introduced in the Senate by Senator Sparkman (D-Ala.), chairman of the Senate Small Business Committee and in the House by Rep. Patman (D-Tex.), chairman of the House Small Business Committee. The proposals have strong backing from members of both committees, as well as other members of both Senate and House interested in the welfare of small, independent businesses.

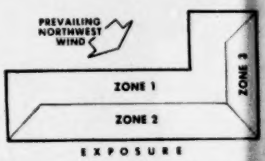
Defense Mobilizer Charles E. Wilson and Defense Production Administrator William H. Harrison both promised the committees full cooperation in helping small business firms get a fair share of defense business.

We can't help you heat bear caves, but we can help you plan better Zone Control heating systems. So fill out the coupon below and send it to us for

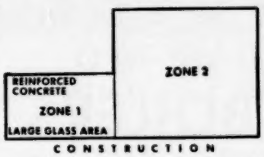
FACTS YOU NEED—FREE!



An excellent way to achieve uniform comfort and economy in heating large buildings—institutional, commercial or industrial—is through the use of Honeywell Zone Control. Separate heating zones in a factory, for example, enable you to keep office workers comfortable in their zone—while at the same time you maintain one low economy temperature in the fabrication zone, and still another fuel-saving level in the storeroom area. And in addition to occupancy and use requirements, Honeywell Zone Control equipment helps you compensate for *all* weather factors and varying heat losses.



In the home field, too, demands for uniform comfort in larger houses have accelerated the trend toward Honeywell Zone Control. For with Honeywell Zone Control you can maintain the desired temperature in every part of the house despite wide differences in exposure, use, occupancy and structural heat losses. And Zone Control makes it possible to lower temperatures for economy's sake during the parts of day when certain sections of the house are not in use.



For additional, specific information on the use of Zone Control, fill in and mail the accompanying coupon now. It will bring you material you'll want to read—and keep handy in your files.

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Minneapolis 8, Minnesota, Dept. HV-2-20

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☐ Large buildings ☐ Homes

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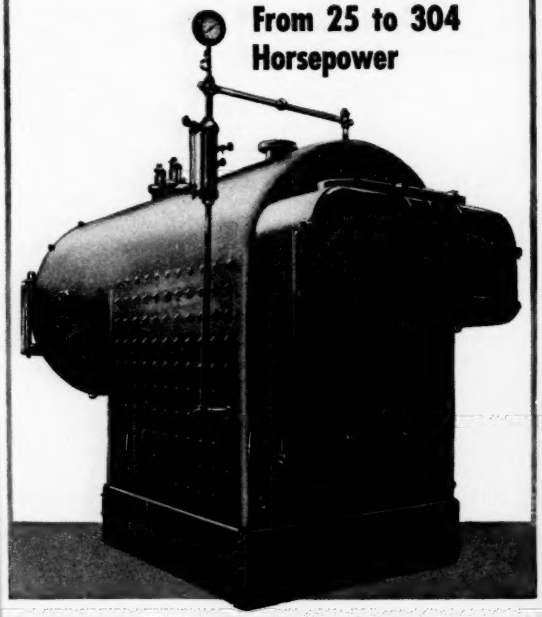
In One Compact UNIT...

DEPENDABILITY

for every need...

From 25 to 304 Horsepower



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Firebox BOILERS

The *only* all-welded, return tube, firebox type high pressure boiler—providing leakproof, troubleproof performance on continuous schedules for hospitals, institutions and industries. The Titusville Type WP-WPO Firebox Boiler is precision die formed and welded—built to ASME code with a 5-plus factor of safety—Standardized ratings, with large reserve capacity—gives excellent results with oil, gas or coal firing. Write for detailed, descriptive brochure.

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BUSINESS PRESS EDITORS

mobilize for emergency as President Truman presents award to executive committee chairman.

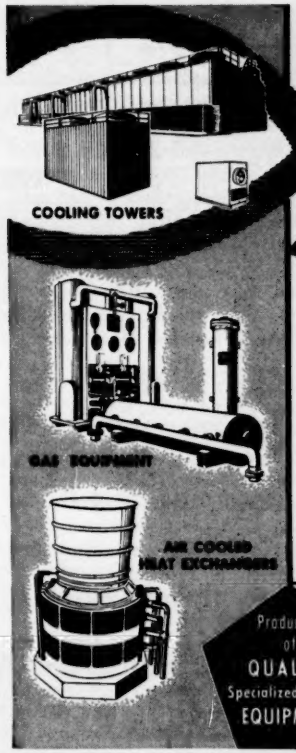
A new chapter of progress and recognition for the business press was written in Washington January 19. The Society of Business Magazine Editors, of which HEATING AND VENTILATING is a member, in a successful business-mobilization conference, rallied top officials of the government, industry and the professions in outstanding sessions headlined by an address of the President of the United States at the mobilization dinner.

Leaders of the government, including members of Congress attending the dinner, remarked on the effectiveness of business press mobilization. Observed Senator Allen J. Ellender, chairman of the Senate Agriculture Committee and member of the Appropriations Committee: "In my opinion other organizations in this country should follow this type of mobilization meeting and rally their people in this crisis. Until tonight I did not fully realize the importance of the business press in our economy."

President Harry S. Truman presents first annual Silver Quill Award of National Business Publications to Paul Wooton of the Society of Business Magazine Editors.

• **AWARD.**—President Truman, in making the presentation of the first annual Silver Quill Award of the National Business Publications to Paul Wooton, chairman of the executive committee of the society, paid a brilliant tribute to his work. The Chief Executive, in homey, heart-warming comments, had various nice things to say about his contacts with the recipient of the award. The President, before switching to the national and international scene, explained that Paul Wooton has "received many honors" during his long tenure as a Washington correspondent and a business press representative in the Nation's Capital. He appealed to the editors to "put out the facts" for the industries they represent and, in the end, he said, we will win the struggle against aggression and inflation.

W. H. Harrison, Defense Production Administrator,



Pritchard's *NEW*, Better-Than-Ever Packaged Cooling Towers Help You Save Water

You can now put water conservation to work efficiently and economically on air conditioning and refrigeration installations with Pritchard's new Series "P" Packaged Cooling Towers. This *low cost* Induced Draft Tower is built to give up to 20 tons capacity.

Manufactured of highest quality materials, the Series "P" tower is shipped either "knocked down" or shop assembled, and is available in painted steel, stainless steel or aluminum. Easily installed. Protect our natural resources. Prevent water wastage!

Wherever you see a Pritchard Cooling Tower, you see water conservation at work!

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THE GAS-AIR MIXERS THAT ARE BETTER 3 WAYS

- SHORTER—because Bryant design locates air shutter on body, where it cannot be removed or "lost" even if backed entirely out of the way.
- QUIETER—because shutter design muffles air entrainment noises.
- EASIER TO SERVICE—because orifice spud can be removed without "breaking" pipe.

Where high-pressure gas is available, *Hijectors* eliminate the need for blower or pressure air. For complete information, write for Data Sheet 5B-1. Bryant Industrial Division, Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, Ohio.

*HIJECTORS (trade name copyrighted): improved venturi mixers for high-pressure gas up to 35 pounds.

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COMBUSTION FOR INDUSTRY
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for • SPRAYING
• WASHING
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SPRAY NOZZLES

FAN-TYPE FOR FLAT SLICING SPRAY

Get the most out of your Spraying Equipment with minimum power . . . with efficient spraying.

Use Yarway Nozzles. No internal vanes or other restrictions to clog or hinder flow. Two types—Yarway Involute-type producing a fine hollow spray with minimum energy loss, and Yarway Fan-type producing a flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Cast or machined from solid bar stock.

Thousands in use. - - Write for Bulletin N-616.

YARNALL-WARING COMPANY
104 Mermaid Avenue **Philadelphia 18, Pa.**

making the closing address at the dinner meeting, declared the challenge that is facing the United States is the expansion of productive capacity. General Harrison told of the plans underway to increase output. Meanwhile, in this "transition period," he said some dislocations are taking place and more can be expected. He appealed for "patience, especially with controls." Regretfully, he said, controls must be resorted to in the crisis.

• **RESOLUTION.**—Following General Harrison's remarks, announcement was made of a resolution passed by the society at its afternoon session. The resolution was as follows:

Whereas, It is now clear that we who believe in the freedom of mankind are involved in a great world struggle with those who do not;

And whereas, this struggle may be the last opportunity to prove that free labor, led by free management, can produce more than slave labor under dictators;

Therefore, be it resolved, that we who enjoy individual freedom as independent editors of American business magazines do hereby pledge ourselves as editors to arouse and support the kind of productive effort that will demonstrate the omnipotent power of the free spirit;

And be it further resolved, that a copy of this resolution be delivered to the President of the United States, to the Director of Mobilization, and to the Administrator of Production.

HEAT TRANSFER OIL

used in huge snow-melting ramp for bus terminal.

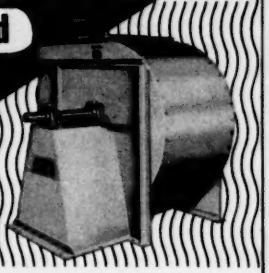
The Port of New York Authority is making sure that wintertime ice and snow will not affect operations in the $24 million Port Authority Bus Terminal which occupies an entire block between Eighth and Ninth Avenues and Fortieth and Forty-first Streets in Manhattan. A special heat transfer oil will be circulated in a network of subsurface piping included in the concrete for 70,000 sq ft of reinforced concrete ramp connections to the suburban bus and roof levels of the terminal.

• **OIL.**—The piping will contain 11,000 gallons of S/V Sovaloid S, a petroleum product of Socony-Vacuum Oil Co., Inc. It will be circulated during snowstorms or cold periods when ice might form, estimated to total about 200 hours per year. S/V Sovaloid S has a pour point of —40F and will be circulated by a central heating and pumping unit in the terminal, when it is needed, at a temperature of 175F. Being noncorrosive, S/V Sovaloid S also minimizes future need for replacing any of the pipes.

Especially developed for snow melting systems, the oil is similarly suitable for controlling ice and snow on airplane runways, in parking areas, highway grades and for the sidewalks of large office and department

MASSACHUSETTS

Squirrel Cage and Power Fixed FANS



SQUIRREL CAGE FANS

Fan wheels have low speed characteristics. The low air velocities permitted are conducive to efficient operation. Housings are rugged and compact. Wheel sizes Single Width 13½" to 86½" dia. Double width 18" to 86½" dia.

POWER FIXED FANS

Backward curve blade type with non-overloading characteristics. Housings are constructed of steel plate and reinforced with heavy bracing angles. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia. Class I or Class II construction for better fan selection.

Write for catalogs.

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DUX-SULATION

ASBESTOS PROTECTED

- INSULATES DUCTS
- ABSORBS SOUND
- SAVES FUEL
- STOPS CONDENSATION
- REDUCES POWER COSTS

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HOW the exclusive SUPER-SILVERTOP GUIDED BUCKET Saves Money

The exclusive Super-Silvertop guided bucket saves money by preventing damage to the bucket. A patented guided tube positively controls the bucket, eliminating the possibility of any bucket swing which might impair the bucket and lead to high replacement cost. But this is only one reason why Super-Silvertops cost *less* in operation than any other trap. In addition, the engineered Super-Silvertop bucket lever assures positive seating . . . preventing costly leakage of live steam. Furthermore, these money-saving traps can be installed in a minimum of time, straight in line or as an elbow and can be serviced without disturbing a single fitting. It pays to standardize on Super-Silvertops. Talk it over with your nearest authorized Super-Silvertop representative or write us for a copy of "Solving Steam Trap Problems."

FREE STEAM TRAP DATA BOOK

THE V.D. ANDERSON COMPANY

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Gentlemen: Please send me a copy of "Solving Steam Trap Problems."

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In Canada: Bowden Machine Co., Toronto

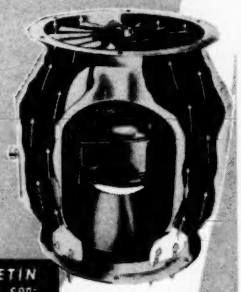
SOLVE DIFFICULT STACK PROBLEMS ECONOMICALLY with

DE BOTHEZAT *Induced Draft* BIFURCATOR FANS

There's no guesswork when DeBothezat trained engineers recommend the right Induced Draft Bifurcator Fan for your particular boiler. DeBothezat fan selection is based on more than merely boiler HP or pounds of fuel fired per hour. In addition, consideration is given to specific temperatures, the resistance of each boiler to airflow and other confidential data furnished on each make and size of boiler by the manufacturer. With DeBothezat, you're sure of the correct size fan unit for maximum efficiency.

HOW THE BIFURCATOR WORKS

The DeBothezat Bifurcator is a direct motor-driven fan with a divided housing, easily installed in a vertical stack or horizontal or angular breeching. Gases are by-passed around the motor, which remains cool, clean and easily accessible. No special platforms or supports are required. Standard fans, 12" through 36" in diameter, for boilers having nominal ratings up to 400 BoHP, or 56,000 EDR.



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American Machine and Metals, Inc.
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store buildings. Characteristics of the oil are as follows:

Gravity, °API @ 60F/60F	10.0 Average
Specific Gravity @ 60F/60F	1.00
Flash Point, COC, °F	260 Minimum
Pour Point, °F	—40
Viscosity Kinematic Centistokes	
@ 175F	1.7
@ 100F	3.9
@ 50F	10.0
@ 0F	48.0
@ —10F	70.0
Coefficient of Expansion	.00035 per Degree F
Distillation Range	
Initial Boiling Point, °F	500 Minimum
Final Boiling Point, °F	640 Maximum
Specific Heat @ 180F	0.47
@ 100F	0.43
@ 60F	0.42
@ 0F	0.39

The new five-level concrete and brick Port Authority Bus Terminal was started in January, 1949, and began operations at the end of 1950. In all, the terminal has 40 loading berths for long-haul buses and 71 berths for loading suburban or commuter buses, a total of 111 berths. It is expected to handle 130,000 bus passengers per day on 2,500 intercity buses.

NEW SEALER

solidifies in absence of air, remains liquid in air.

A material which remains liquid as long as a stream of air bubbles through it, but which hardens in a few minutes when away from air, has been developed in the chemistry divisions of the General Electric Research Laboratory. Its properties are thus opposite to those of paint, which hardens when exposed to air.

• **PIPE DOPE.**—According to Dr. C. G. Suits, G-E vice president and director of research, this new material is able to penetrate extremely small cracks before hardening. Thus, a possible application is a tight seal for stopping nearly invisible leaks, or a "pipe dope" for sealing threaded unions. The laboratory scientists responsible for the new development are Dr. Robert E. Burnett and Birger W. Nordlander.

They call the substance "anaerobic permafil," borrowing a word from the biologists. The term "anaerobic," which means "non-airliving," was coined by Louis Pasteur. It is used by bacteriologists to designate organisms that remain inactive in the presence of air, but which thrive and propagate when air is absent.

• **DEVELOPMENT.**—Anaerobic permafil is the latest in a series of related compounds called "permafils," which the G-E chemists have developed, said Dr. Suits.

Dr. Robert E. Burnett (right) applies anaerobic permafil to a pipe joint, while B. W. Nordlander examines another joint sealed with its aid. These GE chemists developed this material.

Originally they were called "solventless varnishes." Ordinary varnishes, he explained, contain some solid resin dissolved in a liquid solvent. When applied to a surface the solvent evaporates and the varnish remains as a hard layer.

• **APPLICATIONS.**—Such varnishes are difficult to use in some applications; for example, between pieces of metal placed closely together. The solvent nearest the air evaporates, leaving a skin of varnish which seals in the remaining liquid so that it cannot escape. Permafils, on the other hand, are compounds in which the liquid completely undergoes a chemical change, called polymerization, and hardens fully without the necessity of any evaporation. Generally this is accomplished by heating, or by adding other chemicals, called catalysts and accelerators, to speed the process.

Anaerobic permafil, explained Dr. Suits, remains liquid as long as it is aerated. When away from air it solidifies quickly, without heating, or adding catalysts and accelerators.

When two metal strips are coated lightly with it and clamped together the joint will support ten pounds after ten minutes. After 20 hours, it will hold 100 pounds. If still faster hardening is desired, the permafil may be heated, up to 212F, and solidification takes place in a minute or less.

The chemists found that certain metals, such as copper, iron, and silver solder, exert an accelerating action on the hardening process, even at room temperature. Therefore, they can be sealed more quickly than surfaces of glass and mica, which are inert; though they, too, can be tightly fastened. Paper and fabric also may be bonded to themselves and to other materials.

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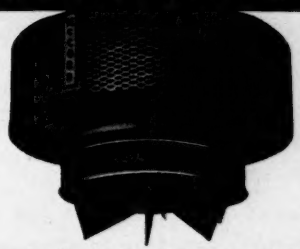
HEATING AND AIR CONDITIONING PRODUCTS

HORIZONTAL TYPE UNIT HEATERS

Modern design—top performance—thousands in use—dependable heat. All copper coils to resist corrosion — individual tube expansion — most rugged construction — quiet operation — easy installation—standard motors with standard bases. Sizes to 272,000 B.T.U. capacity.

VERTICAL TYPE UNIT HEATERS



A proven heating unit—all copper coils to resist corrosion. McCord spiral tube fin construction creates air turbulence without undue restriction. Improved fan delivers large volume of air, with minimum air noise. All McCord heaters are guaranteed for use with 150 lbs. saturated steam pressure. Sizes to 575,000 B.T.U. capacity.

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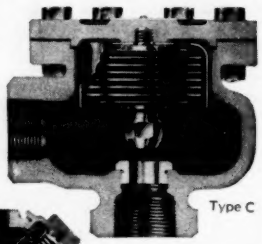
15 of 20 Engineers Prefer Nicholson Traps

To determine the best steam trap on which to standardize, a large processing firm recently asked their plant engineers for their preference. In 15 out of 20 plants the choice was Nicholson. The repeated adoption of Nicholson steam traps by plants currently in big "cost-reduction-through-modernization" programs is another indication of their advanced features. To learn why an increasing number of leading plants are standardizing on Nicholson thermostatic steam traps send for our catalog.

5 TYPES FOR EVERY APPLICATION, process, heat, power. Sizes ¼" to 2"; press. to 225 lbs.



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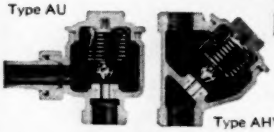

Type AU

Type AHV

BULLETIN 450 or see Sweet's

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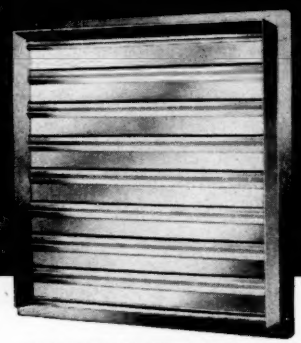
Sales and Engineering Offices in 53 Principal Cities

they all want AIR-FLO



MODEL A-555

THE AUTOMATIC SHUTTER WITH ALL THE FEATURES

Front View—Closed

IT TAKES THE LOAD OFF THE FAN!

Aluminum louvers open fully, permitting capacity fan operation. New heavy reinforcement strip adds strength and long life to the louvers, assures quiet operation and perfect counterbalance, prevents rattling. Deep shroud protects shutter from high winds. Tie-rod, brackets and bearings inside frame, not exposed to weather. Special finish resists corrosion. Many other features.

Write for New Air-Flo Catalog 43-F

Illustrations and details of the complete Air-Flo line.

AIR CONDITIONING PRODUCTS CO.
2340 W. LAFAYETTE BLVD. • DETROIT 16, MICH.

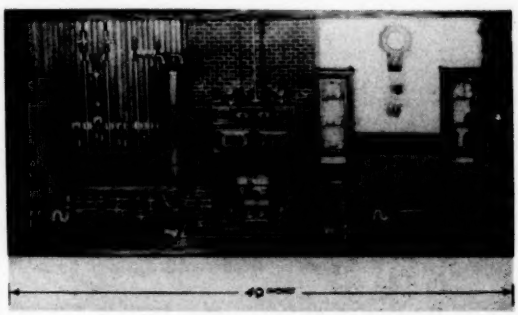
Dr. Suits said that one proposed use of anaerobic permafil is to eliminate the lock-nut needed to hold another nut tightly on a bolt. A few drops are placed on the threads of the bolt just before the nut is screwed on. The plastic hardens so tightly that very considerable force is required to remove the nut.

Another use is for sealing against leaks. The permafil may be applied to threaded joints in pipes, where the liquid penetrates into the crevices and then hardens. Also, if painted on porous castings, it enters the pores and renders the casting airtight.

Dr. Suits said that anaerobic permafil is still the subject of experimental investigation, and thus far only limited laboratory quantities have been produced. It is not yet available commercially, he stated, though plans are being made to put it on the market at a later date.

NEWS PIX

The grade of Fellow in the American Society of Mechanical Engineers has been awarded Thomas A. Marsh, national industrial engineer for Iron Fireman Manufacturing Co. The honor was bestowed by the Joint Fuels Conference of the Fuels Division, ASME and the Coal Division, AIMME. This is the second major honor accorded Marsh, who in 1945 received the Percy Nicholls Award, given for notable scientific or industrial achievement in the field of solid fuels.



A display featured at the Federal Boiler Co., Inc., exhibit at the 10th International Heating and Ventilating Exposition depicts, in accurate miniature, the "modern kitchen" of the early 1900's. It was loaned to Federal by Mr. Robert Smolka, president of Glauber, Inc., one of the leading plumbing supply houses in the New York City area. Every piece in the display, from the chandelier to the wash drains, is hand carved.

Convention and Show

(Continued from page 115)

conditioning in its relationship to prevention of disease, described a new air conditioned experimental wing constructed at the University of Illinois Medical School wherein the effect of air conditioning on post-operative and cardiac patients will be studied. Where peripheral circulation is inadequate, excess heat is less easily dissipated and the heart is required to force blood through constricted vessels with a resulting cardiac strain.

Problems following atomic blasts were covered by Capt. Oscar Schneider, U.S.N. He pointed out that the harmful effects of radiation were the result of ionization within the body tissues. Ionization brings about irreversible changes in body chemistry, particularly in the blood-forming tissues and digestive tract.

Heat Losses from a Floor Panel

Losses from a Floor-Type Panel Heating System were described by F. W. Hutchinson, professor of mechanical engineering, University of California, and D. L. Mills and L. J. LaTart, engineers, Revere Copper & Brass Inc. They covered the results of an investigation on heat losses from two floor-type panel heating systems in buildings at Rome, N. Y., during the two heating seasons of 1948-49 and 1949-50. In addition to the heat loss data, experimental results were also presented giving the actual rating of a unit area of floor panel and the combined film coefficient of heat transfer for such a panel as evaluated from tests.

Both of the floor-type panel heating systems, installed in regularly occupied rooms of an industrial building, use ¾-inch sinuous coil copper tube on 9-inch centers. Coils were embedded in a 4-inch concrete slab poured over a 6-inch gravel fill. No insulation was provided under or at the side of the slabs, or the structure, and in each case the heated section of floor was less than total floor area. Cellular insulation, ¾ inch, separated heated from unheated floor sections.

Edge and rear losses, which could not be separated in these tests, were found to agree very closely on all tests and to be of the order of 30% of total energy supplied to the heating systems. Results indicate that some type of insulation is required with floor-type panel heating if the operating cost is to be kept at a reasonably low value.

Film coefficients of heat transfer calculated from test data agreed very closely with the values obtained by other investigators and suggest that an acceptable design value of combined radiation and convection film coefficient for floor heating panels is 2.1 Btu per (hr) (sq ft) (F deg temperature difference from panel surface to air).

Heat Losses from Concrete Floor Panels

Four single story basementless frame houses were used in a field study during the heating season of 1949-50 to determine the order of magnitude of heat losses from floor slabs to earth and to study the effectiveness of insulation in reducing these losses.

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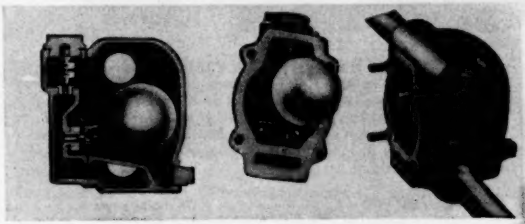

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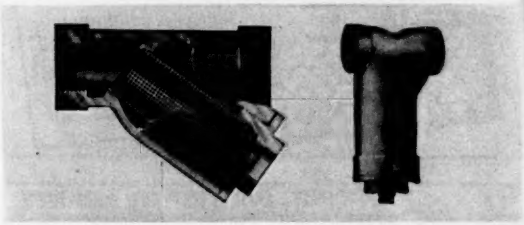

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C. M. Humphreys, C. V. Franks and L. F. Schutrum, all of the staff of the ASHVE Research Laboratory, conducted this study on these houses located at Parma Heights, Ohio, and the findings were given in a paper, Field Studies of Heat Losses from Concrete Floor Panels. Data were presented on the heat losses from floor panels in the four houses.

The studies indicated that the greatest part of the heat loss from a floor panel occurs around the perimeter of the panel. It is in this area that insulation will prove most effective. It is particularly important that the panel be separated from the foundation by suitable insulation.

Four-inch hollow clay tile, it was found, does not appear to be any more effective as an insulation under a floor panel than an equivalent thickness of gravel. Its use as an edge insulation was not studied.

Bituminous-Coal-Burning Heaters

Information obtained as the result of research work sponsored by Bituminous Coal Research, Inc., and carried on at Battelle Memorial Institute was drawn on by John W. Tieman, research engineer, and Frederick L. Bagby, assistant supervisor, Battelle Memorial Institute, in the preparation of their paper on The Efficiency of Bituminous-Coal-Burning Space Heaters.

A test calorimeter room was constructed at the institute, and this was described as well as the tests that were conducted on two deep fire-pot heaters, a smokeless heater, and a conventional surface-fired heater when burning high volatile bituminous coal. All heaters that were tested were commercial models. The room in which the tests were run permits an accurate determination to be made of the heat losses in the form of smoke and unburned tars and gases which, in the past, in conventional tests, have been termed the unaccounted-for loss.

The paper presents data on the useful heat transmitted to a room from a typical flue pipe installation. Curves are given for the four heaters tested showing over-all house heating efficiency, when the useful heat from the flue pipe, plus that from the chimney, are taken into account. The object of the work discussed in this paper was to obtain the relation between heater efficiency and the rate of heat output.

Measurement of Smoke

The Measurement of Smoke was described by K. O. Beatty, Jr., professor of chemical engineering and James E. Deas, Jr., research assistant, Department of Engineering Research, both with North Carolina State College, Raleigh, N. C.

Three methods for the measurement of smoke have been adopted for laboratory use and specific information obtained by the use of these three methods simultaneously over a wide range of operating conditions. The three methods are the ICHAM (The Institute of Cooking and Heating Appliance Manufacturers); the NCS (modification of the filter spot method developed at North Carolina State College); the photoelectric smoke method.

The tests indicated that it is impossible to say that one method is better than the other. It can only be

said that they are different. If no correlation exists when all measurements are made on fuel oil burned in a single furnace, as it was in this investigation, agreement could not possibly be expected with a variety of furnaces or different fuels.

The authors state that a conclusion must be drawn that each method measures different aspects of smoke and not smoke itself. The simultaneous use of several methods gives more complete information than any one alone can give. Use of several methods should aid in prediction of the effect of combustion conditions on the performance of fuels.

INDUSTRIAL DEGREE-DAYS
December, 1950

City	55F Base	45F Base
Baltimore, Md.	585	293
Buffalo, N. Y.	858	553
Chicago, Ill.	961	651
Cleveland, Ohio	921	611
Detroit, Mich.	908	598
Indianapolis, Ind.	971	667
New York, N. Y.	614	315
Philadelphia, Pa.	606	313
Pittsburgh, Pa	774	471
St. Louis, Mo.	777	484

Canadian Degree-Days for December, 1950*

City	December		Cumulative Sept. 1 to Dec. 31	
	1950	Normal	1950	Normal
Calgary, Alta.	1380	1426	4050	3702
Charlottetown, P.E.I.	1026	1246	2663	2865
Crescent Valley, B. C.	1057	1240	3006	3279
Edmonton, Alta.	1654	1578	4483	3984
Fort William, Ont.	1773	1596	4074	3815
Grande Prarie, Alta.	1770	1649	4781	4159
Halifax, N. S.	894	1138	2274	2615
London, Ont.	1302	1200	2858	2677
Medicine Hat, Alta.	1389	1417	3584	3389
Moncton, N. B.	1116	1373	2834	3186
Montreal, P. Q.	1339	1407	2941	3096
North Bay, Ont.	1569	1528	3638	3503
Ottawa, Ont.	1426	1494	3180	3277
Penticton, B. C.	902	1073	2495	2626
Porquis Junction, Ont.	1857	1786	4338	4248
Prince George, B. C.	1324	1504	4134	3757
Quebec City, P. Q.	1330	1534	3082	3511
Regina, Sask.	1843	1779	4463	4336
St. John, N. B.	1045	1271	2661	2969
Saskatoon, Sask.	1879	1767	4577	4249
Toronto, Ont.	1127	1155	2449	2644
Vancouver, B. C.	686	818	2091	2168
Victoria, B. C.	632	738	2019	1910
Windsor, Ont.	1265	1172	2570	2446
Winnipeg, Man.	1959	1829	4259	4205

*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.
The Department reports a slight revision in the figure for November for Grande Prairie, as published in last month's issue. Corrected figure is 1734.

AIR-MAZING FACTS

BY O. SOGLOW

FEEL A DRAFT? In order for air in motion to be called a draft it has to be moving at a speed of at least 3.5 feet per second. Authorities say that the average person can't detect air in motion unless it's moving that fast.

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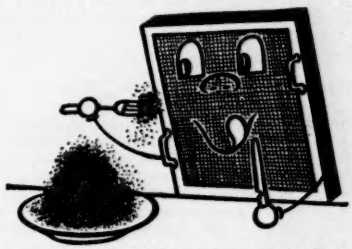

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Getting Personal

K. J. Caplan

Knowlton J. Caplan *(High Efficiency Collection of Radioactive Dust,* page 79) received a Master of Science degree in chemical engineering at Washington University in 1942. He has had experience in industrial ventilation and industrial hygiene in Missouri and Michigan state governments, and in the U. S. Public Health Service during the war years. In March, 1948 he went with Mallinckrodt Chemical Works to organize and direct the industrial health function in their atomic energy work. In his present position he directs the efforts to achieve control of dust, gas, and radiation problems.

S. J. Friedman *(Proper Selection of Drying Equipment,* page 95) whose biography was published in the April, 1948 issue of HEATING AND VENTILATING, is associated with the Engineering Research Laboratory, Engineering Department, E. I. du Pont de Nemours & Co., Wilmington, Del. He is co-author of the section on Drying in the third edition of the Chemical Engineers' Handbook, edited by John H. Perry.

H. F. Eastwood

Harry F. Eastwood *(Tailoring an Anthracite Boiler to an Overfeed Rice Stoker,* page 84) began his career as a member of the firm of Sanders & Eastwood, heating specialists of Boston, Mass. During World War I, Mr. Eastwood was on active service in the U. S. Navy. In 1919 he entered the U. S. Merchant Marine as an assistant engineer and left the service as a chief engineer in 1921. He was in charge of building maintenance and engineering of the New York Federal Reserve Board upon completion of their first building in 1921. He became resident engineer with the Newton Supply Company of Philadelphia for the Combustion Specialties Corporation in New York in 1924. In 1926 he designed and patented a device known as the draft balancer, to assist the balancing of oxygen supply to burning rate with forced draft. He became vice president and chief engineer of the Combustion Specialties Corp. of New York until the depression terminated that activity in 1930. After a period of service with Anthracite Institute and independent sales and engineering activities, he designed, in 1940, the baseboard radiation which is now being marketed by Warren Webster. In 1944 he joined the Philadelphia and Reading Coal and Iron Company as New York fuel engineer and most of his effort has been to promote ways and means of automatically burning smaller sizes of anthracite.

Correction

In the story of the snow melting system installed for the John Wannamaker store, Wilmington, Del., that appears in H & V, January, 1951, page 91, the article inadvertently failed to state that the coils are constructed of wrought iron pipe.

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

IRON AND STEEL CONFERENCE — Two-day conference on Instrumentation for the Iron and Steel Industry, in Pittsburgh, Pa., sponsored by the Pittsburgh Section of the Instrument Society of America and the Carnegie Institute of Technology. L. M. Susany, general chairman, Carnegie Library, 4400 Forbes St., Pittsburgh, Pa. ..... **MARCH 28-29, 1951.**

ASME MEETING—Spring meeting of the American Society of Mechanical Engineers, at the Hotel Atlanta-Biltmore, Atlanta, Ga. C. E. Davies, secretary of the Society, 29 W. 39th St., New York, N. Y. ..... **APRIL 2-5, 1951.**

OIL HEAT EXPOSITION—19th National Oil Heat Exposition, at Navy Pier, in conjunction with the 28th annual convention of Oil-Heat Institute of America, at the Palmer House, Chicago, Ill. C. F. Curtin, secretary, 6 East 39th St., New York 16, N. Y. ..... **APRIL 2-6, 1951.**

POWER CONFERENCE—14th annual Midwest Power Conference, sponsored by Illinois Institute of Technology, at Hotel Sherman, Chicago. Conference director, Roland A. Budenholzer, at Illinois Tech, Technology Center, Chicago 16, Ill. ..... **APRIL 4-6, 1951.**

LUBRICATION SHOW — Annual convention and lubrication show of the American Society of Lubrication Engineers, at the Bellevue-Stratford Hotel, Philadelphia, Pa. W. F. Leonard, secretary of Society, 343 South Dearborn Street, Chicago 4, Ill. ..... **APRIL 16-18, 1951.**

FOUNDRYMEN'S CONVENTION—55th annual convention of the American Foundrymen's Society, in Buffalo, New York. William W. Maloney, secretary-treasurer of the Society, 616 S. Michigan Ave., Chicago 5, Ill. ..... **APRIL 23-26, 1951.**

REFRIGERATION MEETING—Annual meeting of the Refrigeration Equipment Manufacturers Association, at The Homestead, Hot Springs, Va. George E. Mills, public relations director, REMA, 1346 Connecticut Ave., N.W., Washington, D. C. ..... **APRIL 30—MAY 2, 1951.**

ARCHITECTS CONVENTION—1951 convention and national seminar meetings of The American Institute of Architects, at the Edgewater Beach Hotel, Chicago, Ill. Paul Gerhardt, Jr., chairman, 121 No. LaSalle St., Chicago, Ill. **MAY 8-11, 1951.**

CONTRACTORS MEETING—62nd annual convention of the Heating, Piping and Air Conditioning Contractors National Association, at the Shoreham Hotel, Washington, D. C. Jos. C. Fitts, secretary of Association, 1250 Avenue of the Americas, New York 20, N. Y. ..... **MAY 8-11, 1951.**

ASRE MEETING—Spring meeting of the American Society of Refrigerating Engineers, at Hotel Statler, Detroit, Mich. M. C. Turpin, secretary, 40 West 40th St., New York 18, N. Y. ..... **MAY 27-30, 1951.**

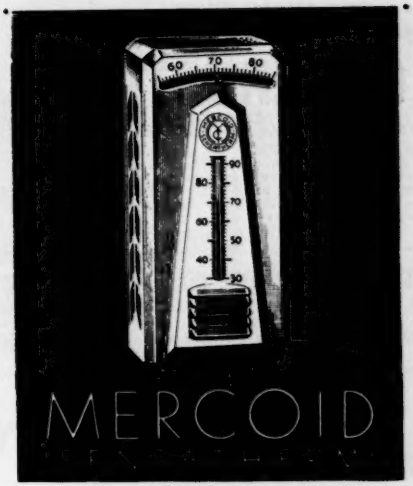
NDHA MEETING—42nd annual meeting of the National District Heating Association, at the Statler Hotel, Detroit, Mich. John F. Collins, Jr., secretary-treasurer of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. ..... **JUNE 5-8, 1951.**

ASME MEETING—Semi-annual meeting of the American Society of Mechanical Engineers, at Hotel Royal York, Toronto, Ont., Canada. C. E. Davies, secretary of the Society, 29 West 39th St., New York, N. Y. ..... **JUNE 18-22, 1951.**

STOKER MEETING — 1951 annual meeting of the Stoker Manufacturers Association, at South Shore Inn, Lake Wawasee, Syracuse, Ind. Marc G. Bluth, executive secretary of the Association, 307 North Michigan Avenue, Chicago 1, Illinois. ..... **JUNE 25-26, 1951.**

INSTRUMENT CONFERENCE AND EXHIBIT—1951 Instrument conference and national exhibit of the Instrument Society of America, at the Coliseum, Houston, Tex. John McCaffery, assistant executive secretary of the Society, 921 Ridge Ave., Pittsburgh 12, Pa. ..... **SEPTEMBER 10-14, 1951.**

REFRIGERATION SHOW—7th All-Industry Refrigeration and Air Conditioning Exposition, at Navy Pier, Chicago, Ill. Show director, REMA, 1346 Connecticut Ave., N.W., Washington, D. C. ..... **NOVEMBER 5-9, 1951.**



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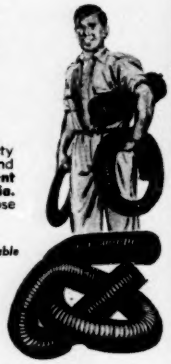

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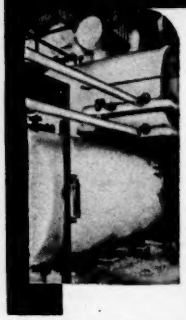

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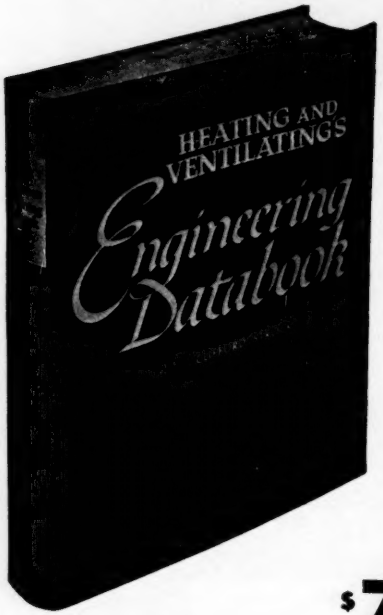

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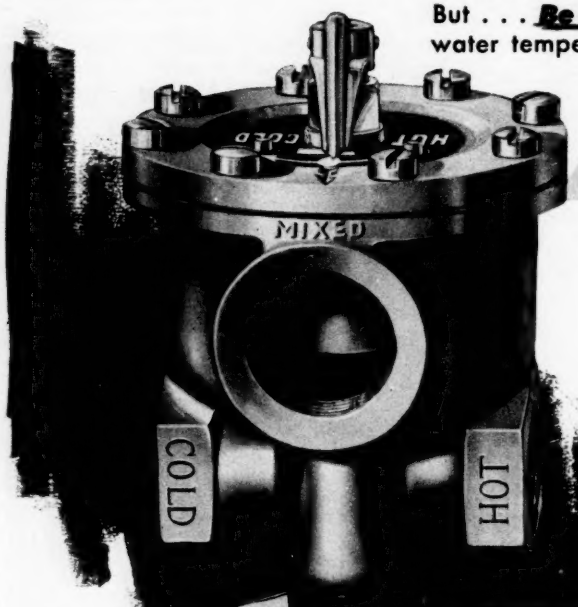

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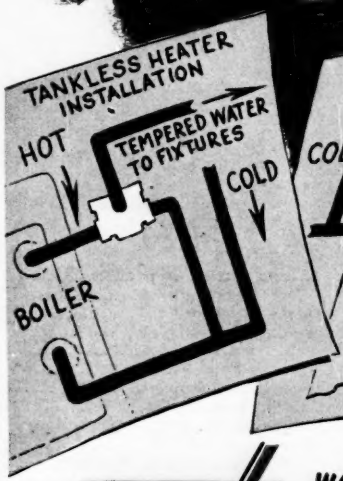
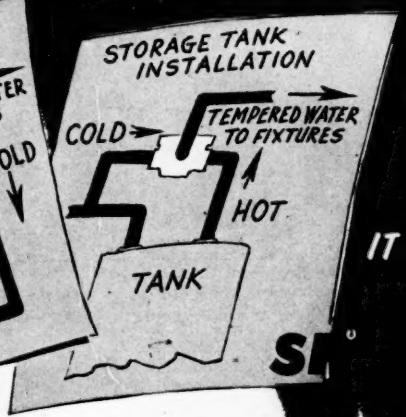
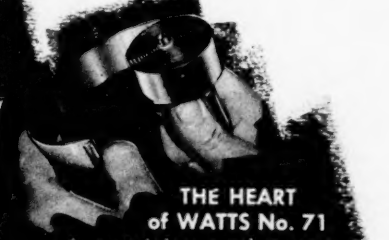
Can be specified with confidence for either tankless heater or storage tank systems and relied upon to deliver accurately tempered water to outlets.

Here's why!

The heart of any tempering valve is its **THERMOSTAT.** If it is attacked by corrosion the entire valve be- es ineffective.







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LAWRENCE, MASSACHUSETTS

MANUFACTURERS OF

PLUMBING and HEATING . . . SAFETY VALVES and CONTROLS

AIR CONDITIONING DESIGN CONDITIONS – INDUSTRIAL PLANTS

(Continued from last month's Reference Data)

Linoleum

Precise control of temperatures and humidity is required in the first basic step in the manufacture of linoleum—the mechanical oxidizing of linseed oil which results in the product that forms the linoleum binder. This is a major operation which is conducted in the presence of air that has been conditioned at a temperature of 90-100F and 20-25% R. H. If temperatures during this oxidizing operation were not controlled, the batch would continue to get hotter and hotter until it became unusable. Eventually, it would burst into flame.

For this reason, the rate of flow and temperature of the cooling water in the jacket surrounding the tank is measured at regular intervals. The volume of air used in the process is correspondingly measured.

After the oxidized linseed oil has been cured for several weeks, it is mixed with the cork flour, minerals and color pigments used in making the various types of linoleum.

Stoving processes for the maturing of linoleum involve heated air and are conducted at temperatures between 160-250F. Relative humidity of the air involved is naturally low at these high temperatures. In terms of absolute humidity, moisture content of 60 gr or less per pound of air is desirable.

While bacteriological control is not a factor in manufacturing operations, some operations are stabilized against the possibility of mold growth.

Machinery Manufacture

Controlled air conditions for various rooms in the manufacture of automobiles are listed in Table 8. These conditions are employed by a major automobile manufacturer.

In offices, drafting rooms and matching rooms where employes spend the entire day, the dry bulb temperature is maintained higher during the summer months to avoid the possible health hazard resulting when one moves from conditioned zones to high temperatures that may prevail outdoors.

Another manufacturer employs air conditioning for—

(1) Precision machining of parts.
(2) Accurate gaging and inspection.
(3) Manufacture and adjustment of precision gages.
(4) Processing of certain kinds of material which can be satisfactorily worked only if their moisture content and temperature are correct.

Conditions maintained for operations (1) and (2) are generally 75F and 45-50% R. H. For (3), conditions are generally 68F and 50% R. H., although at times 75F and 50% R. H. may be permitted. For (4), a great deal depends upon the operation. In one case, a year-round temperature of 65F and 10-15% R. H. is necessary.

For general manufacturing and assembly areas, no attempt is made to control conditions during hot weather. An ample supply of fresh air and air motion are relied upon to provide personal comfort.

TABLE 8—AIR CONDITIONS FOR AUTOMOBILE MANUFACTURE

Room or Process	Temperature, F	Relative Humidity, %
Engineering offices and drafting rooms		
Summer	80	40
Winter	75	25
Spectrographic analysis room		
Summer	80	50
Winter	75	45
Gear matching and special assembly rooms		
Summer	80	40
Winter	75	30
Gasket storage		
All Seasons	100	30
Cement and glue storage		
All seasons	65	40

Machine Assembly

Controlled air conditions are important in the assembly rooms and in some machining operations. Machining tolerances and finishes of parts for precision gear drives are held to such specifications that assembly under constant temperature conditions is essential. Dust counts are held down fairly well in the rooms reserved for assembly and run-in of compressors.

TABLE 9—AIR CONDITIONS MAINTAINED IN MACHINE ASSEMBLY

Room or Process	Temperature, F	Relative Humidity, %
Assembly of precision gear drives	72	42-50
Assembly and run-in of air conditioning compressors	70-76	45-55

Matches

Generally speaking, air conditioning in match manufacture is used only in the drying of the match heads. In older installations, the entire room was air conditioned but in some of the newer ones, only the individual machine is air conditioned. Drying is speeded by keeping the relative humidity low, about 40%, and the temperature 70-75F.

Munitions

Air conditioning for munitions was recognized during World War I when it was used with good results in the manufacture of time ring fuzes. It is important in permitting close gage tolerances and in holding down the moisture content of the explosive charge. Air

conditioning is also important in holding down moisture condensation on ceilings, walls and windows during the winter months.

Because of the danger of explosive dusts carrying a fire from one room to another, usually duct work is not allowed to pass from one explosive room to another, regardless of whether or not outlets are taken off in each room.

Filters in return air ducts can become exceedingly hazardous when powder accumulates on them. The amount of explosive pick-up varies and there is the chance of human error in deciding how often to clean the filter and in judging the amount of powder present.

In rooms where powders are pressed, air distribution must be uniform and very accurately controlled so as to disturb the powders as little as possible. Since the type of items manufactured in air conditioned rooms may change frequently, it is important that the air distribution system be flexible enough to take care of such changing conditions.

Table 10 lists some of the air conditions that must be maintained for various rooms.

The metal parts of percussion elements are rinsed in clear water, after washing, and dried by air at 180-200F. It is important that the paint in the flash holes of an artillery primer dries from the inside out without shrinking. In the first section of the drier, air is maintained at 110F; when the solvents have been removed from the paint, 90F air is blown over the paint surface.

In drying black powder for artillery primers, moisture content is maintained below ¾ of 1% to procure uniform burning of the powder. Black powder is very dusty and is very sensitive to friction. Therefore, it is necessary to supply 100% fresh outside air.

Two types of fuses are used for projectiles: (1) mechanical, which, similar to a watch, requires close mechanical tolerances, and requires air conditioned air in its manufacture to hold down perspiration of the operators; and (2) powder train type, the powder for which must be accurately controlled. Relative humidity is held to within 1% so that the powder moisture content can be controlled to within 0.1% moisture content by weight. More moisture gives a slower timing.

TABLE 10—AIR CONDITIONS FOR MUNITIONS

Room or Process	Temperature, F	Relative Humidity, %
Metal percussion elements		
Drying parts	180-200	—
Drying paint	110	—
Black powder—drying	120-130	—
Powder type fuse		
Conditioning powder	70	40
Powder loading	70	40
Pelleting room for tracer loading	80	35-40

Pharmaceuticals

For the purpose of this tabulation, grouped under the general term of pharmaceuticals is the manufacture of tablets, powders, capsules, ampules, toxines, and the maintenance of small animals for research work.

Conditions maintained in the various air conditioned departments are summarized in Table 11.

Rooms in which filled gelatin capsules are stored should be at 40-50% R.H. at 75F, according to an authority other than quoted in Table 11, and from whom the following is abstracted.

In the manufacture of uncoated pills, the temperature and relative humidity must be kept accurately controlled, for if the humidity is too high, the pills and tablets will not dry at the proper rate, and the powder that may be used as a surfacing will not adhere. If the humidity is too low, a hard outer layer may form before the inside of the pill has had a chance to dry thoroughly. Ideal conditions for a tablet compressing room are from 35% R.H. at 80F to 50% R.H. at 75F.

Conditions in rooms where tablets are coated should be close to 35% R.H. at 80F.

Conditioning of filling and packing rooms should be on a definite basis—not a differential. In most cases 35% R.H. at 78-80F is ideal. An excellent general condition for many purposes is 50% at 75-80F, although many products can be handled most efficiently at 5-10% R.H. at 80F.

Drug manufacturers use large numbers of animals in testing and research work and also for production. While the animals used include guinea pigs, mice, rats, rabbits, monkeys, dogs, cats, chickens, hogs, horses and cows, the ones most frequently used in testing and research work are the smaller animals—mice, guinea pigs and rabbits. Ideal conditions for these animals are 50% R.H. at 77 to 80F. While 60% R.H. is satisfactory, the temperature must be uniform.

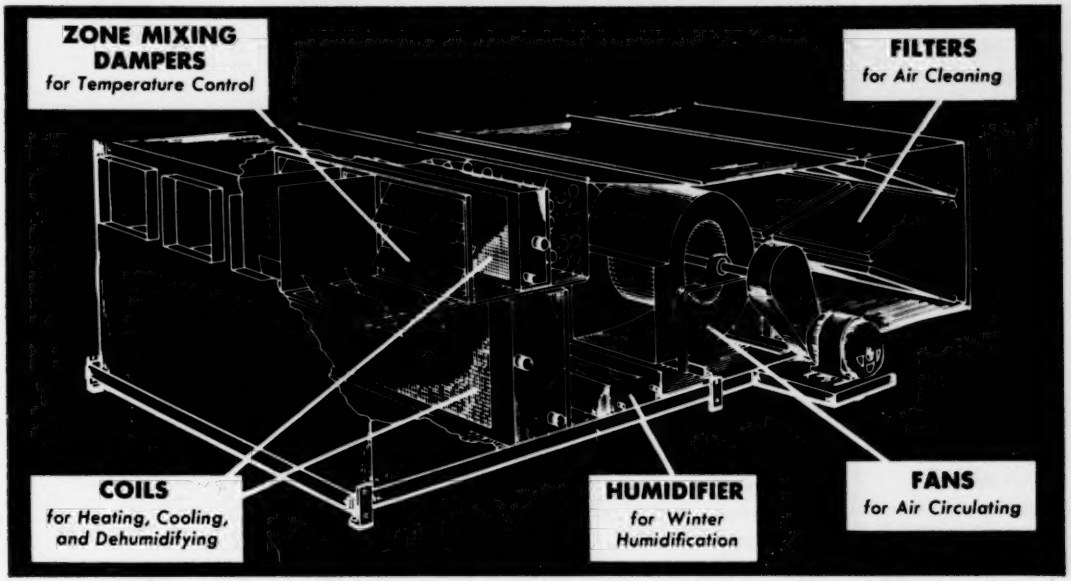
In the research room, it is only necessary to maintain comfort conditions. However, in the micro-analysis room, 80F and 50% R. H. are maintained throughout the year.

TABLE 11—AIR CONDITIONS FOR MANUFACTURE OF PHARMACEUTICALS

Room or Process	Temperature, F	Relative Humidity, %
Tablet compressing department	77	40
Powder storage and packing areas	75	35
Milling room	80	35
Ampule manufacturing department	80	35
Biological manufacturing department	80	35
Liver extract	80	10.5
Serums	74-78	50
Capsule storage	75	35-40
Animal room	80	40
Small animal room	75-78	47-48

(To be continued)

Blow-Thru MULTITHERMS



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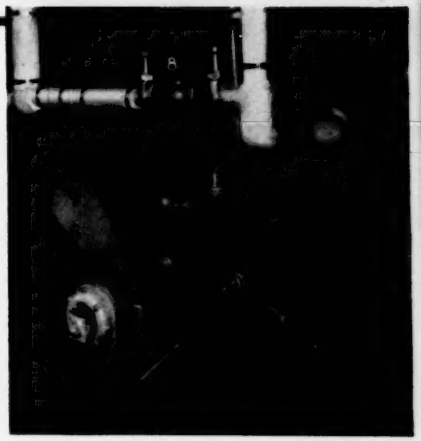
Different Temperatures and Humidities at the SAME Time with ONE Unit

One Clarage Blow-Thru Multitherm can be used to air condition various parts of your building exactly as your requirements warrant.

ZONE CONTROL compensates for the difference in solar radiation on different parts of a building during different times of the day. It also takes into account variations of exposure, wind velocity, construction, and different internal heat loads.

Thus winter and summer, if desired, you can maintain *different temperatures and different humidities* in various parts of your building. Each zone is automatically and independently controlled — yet only ONE Clarage Blow-Thru Multitherm required.



This 3-zone Blow-Thru Multitherm unit air conditions the 2-story office building of the Northern Indiana Brass Co., Elkhart, Indiana. Installation made in December, 1940.

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NEW BULLETIN 1310 gives descriptive details, specifications, capacities, and dimensions. Send for your free copy today.

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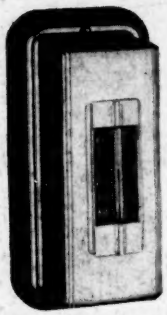
SIMPLE THINGS ARE THE MOST EFFECTIVE!

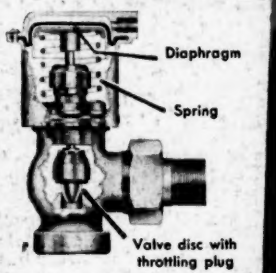
for example... JOHNSON pneumatic temperature CONTROL



PNEUMATIC ROOM THERMOSTAT

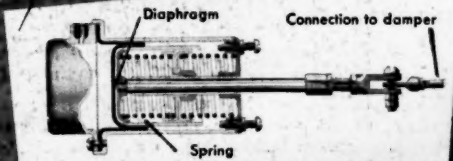
Mechanical equipment which is as simple as possible, commensurate with the requirements which it has to meet, is always the most satisfactory. That is the keynote in designing JOHNSON Automatic Temperature Control apparatus. Each piece of Johnson equipment is just as simple as it is possible to make it. Thousands of Johnson installations, serving for years without end in schools and almost every other conceivable type of building, attest to the wisdom of that policy.

Each Johnson *Individual Room* Thermostat is merely a reducing valve in a compressed air line, set and reset automatically by an accurate bi-metallic temperature measuring element, to transmit compressed air, at varying pressures, to the valves and dampers which it controls. Johnson Diaphragm Valves and Damper Operators, too, are simple devices, with a flexible, long-life diaphragm which is inflated as the thermostat transmits increased air pressure and deflated by a rugged opposing spring when there is a drop in the air pressure. There are no mysteries here. And no complications!



DIAPHRAGM VALVE

To supply power for the operation of the apparatus in a Johnson installation, a small air compressor in the basement automatically maintains the required air pressure in the system of small tubing, concealed in the walls, which delivers compressed air to each thermostat and connects the instrument to the regulators which it operates. Quiet, safe, dependable! And only one electric motor in the entire installation to look after and to feed with electricity.



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CONTINUOUS DEVELOPMENT... The Johnson research and development laboratories not only pioneer in modern advancements but painstakingly ferret out and test all new principles which might be applied to the field of automatic temperature control. Johnson engineers are "Johnny-on-the-spot" in suggesting improvements. IF AND WHEN new developments prove themselves, then—and only then—Johnson manufactures and installs apparatus of new design.

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